SOIL SURVEY OF

Johnson County, Arkansas

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
Arkansas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1967–72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Arkansas Agricultural Experiment Station. It is part of the technical assistance furnished

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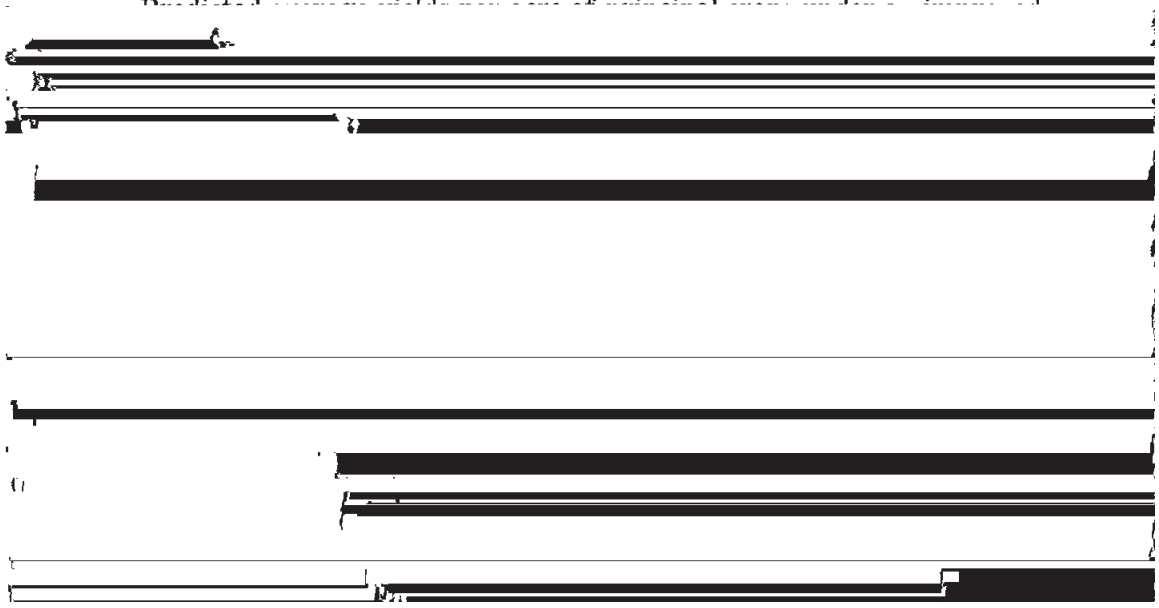

SOIL SURVEY OF JOHNSON COUNTY, ARKANSAS

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE,
IN COOPERATION WITH THE ARKANSAS AGRICULTURAL EXPERIMENT STATION

JOHNSON COUNTY is in the western part of Arkansas (fig. 1). It is irregularly shaped. It ranges from about 10 to 30 miles in width and is about 27 miles in maximum length. The county is bounded on the north by Madison and Newton Counties, on the east by Pope County, on the south by the Arkansas River, and on the west by Franklin County. According to United States Census reports, the approximate area is 435,200

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Johnson County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of

graphs. These photographs show woodlands, buildings, field borders, trees, and other details that help in

fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table.

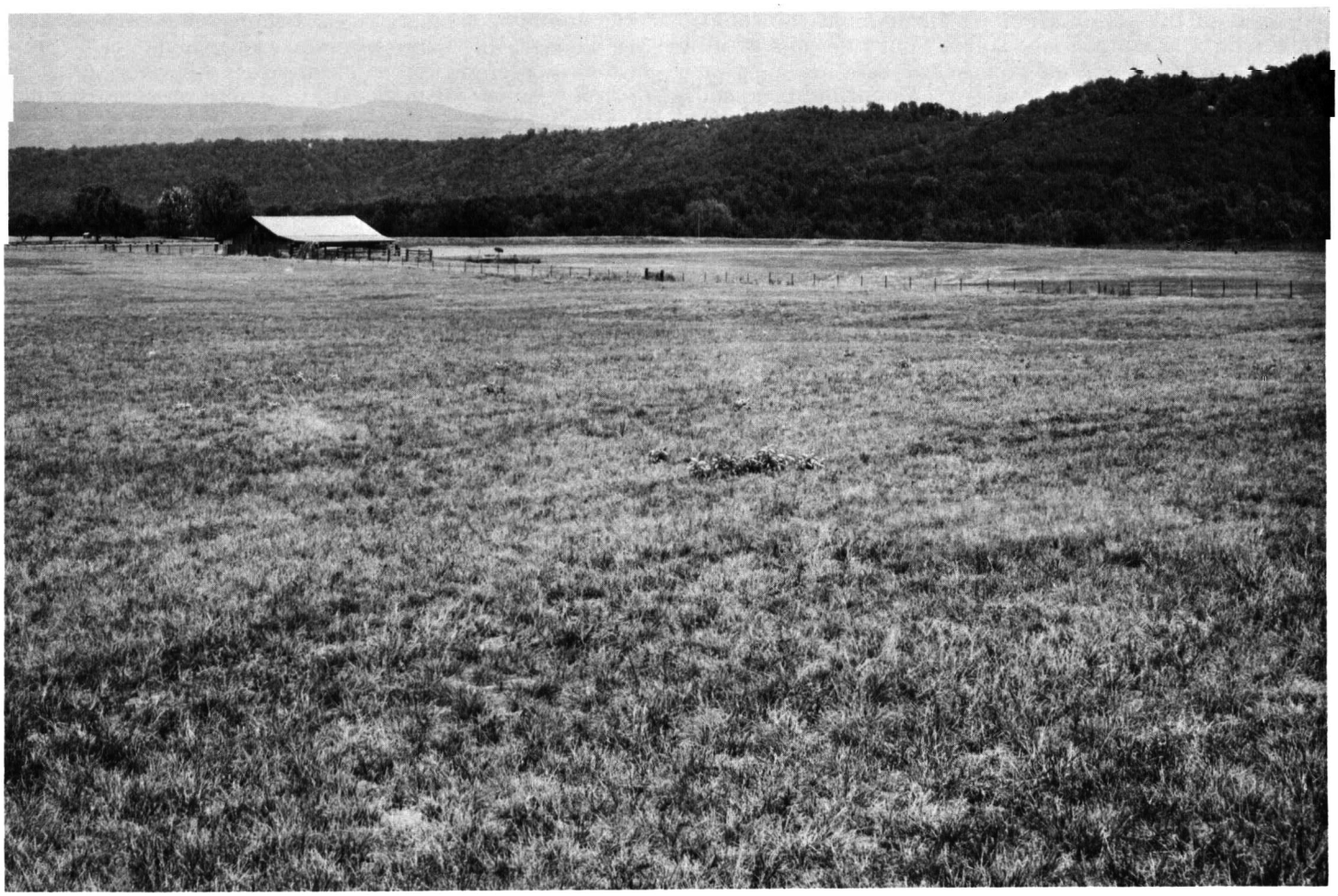


Figure 2.—**Soils of association 1 are in background. (Those in foreground are in association 2.)**

This association is mainly in the northern part of the county on hills and mountains (fig. 2). Nella soils are on toe slopes and benches, and Enders soils are on hillsides and mountainsides. Mountainburg soils are on the tops of hills and mountains and on ledges and benches. Nella soils formed in colluvium derived from acid sandstone and shale. Enders soils formed where the bedrock is acid shale. Mountainburg soils formed where the bedrock is acid sandstone.

This association makes up about 48 percent of the county. Nella soils make up about 45 percent of the association; Enders soils, about 18 percent; and Mountainburg soils, about 16 percent. The remaining 21 percent is Ceda, Leesburg, Linker, and Spadra soils; Rock outcrop; and water areas.

Nella soils are well drained. They have a surface layer of dark brown gravelly fine sandy loam and a subsurface layer of brown gravelly fine sandy loam. The surface layer is stony in some areas. The upper part of the subsoil is reddish brown gravelly sandy clay loam, and the middle part is yellowish red gravelly clay loam. The lower part is red gravelly clay loam.

Enders soils are well drained. They have a surface layer of dark brown fine sandy loam that is gravelly or stony in some areas. The upper part of the subsoil is yellowish red clay loam, and the middle part is yellowish red clay. The lower part is mottled clay, and the underlying material is light gray shaly clay.

Mountainburg soils are well drained. They have a surface layer of dark brown gravelly fine sandy loam. This layer is stony in many areas. The upper part of the subsoil is yellowish red gravelly sandy clay loam, and the lower part is yellowish red gravelly fine sandy loam. In places the subsoil is stony throughout. It is underlain by sandstone bedrock at a depth of 12 to 20 inches.

Generally, soils in this association are unsuited to farming because of slope, depth to bedrock, stony surface layer, or clayey subsoil. Most areas are wooded. Cleared areas are used mainly for pasture. Limitations are severe for most kinds of intensive uses and for septic tank absorption fields because of slope, depth to bedrock, or the slow percolation rate.

2. Linker-Mountainburg Association

Well drained, nearly level to moderately steep, moderately deep and shallow, loamy and stony soils on hills, mountains, and ridges

Areas of this association are throughout the county. Linker and Mountainburg soils are on the tops of hills and mountains, on their side slopes and benches, and on low ridges within valleys. Mountainburg soils formed where the bedrock is harder and more resistant to weathering or where geological erosion has more nearly kept pace with weathering of the bedrock and the parent material is thinner.

This association makes up about 29 percent of the [illegible] about 50 percent of the

used mainly for pasture, although some large tracts are wooded, and some tracts are in urban areas. Limitations are slight to moderate for intensive uses on Pickwick soils and moderate to severe on Spadra soils because of occasional flooding.

4. Leadvale-Cane-Taft Association

Moderately well drained and somewhat poorly drained, level to gently sloping, deep, loamy soils with

This association makes up about 3 percent of the county. Morganfield soils make up about 24 percent of the association; Bruno soils, about 22 percent; Roellen soils, about 18 percent; and the remaining 36 percent is Caspiana and Moreland soils and water areas.

Morganfield soils are well drained. They have a surface layer of dark brown and reddish brown silt loam. The underlying material is reddish brown to dark reddish brown very fine sandy loam and silt loam.

Bruno soils are excessively drained. They have a surface layer of yellowish brown loamy fine sand. The underlying material is light yellowish brown and brown loamy fine sand, loamy very fine sand, and fine sand.

Roellen soils are poorly drained. They have a surface layer of very dark gray clay. The upper part of the subsoil is very dark gray, mottled clay, and the middle part is dark gray, mottled clay. The lower part is dark grayish brown, mottled clay.

Soils in this association, except for Bruno soils, are suited to farming, and most of the acreage is cultivated. Bruno soils are poorly suited to most crops

contains suggestions on how the soil can be managed.

As mentioned in the section "How This Survey was Made," not all mapping units are members of a soil series. Udorthents, for example, do not belong to a soil series; nevertheless, they are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is the symbol that identifies the mapping unit on the detailed soil map. Listed at the end of the description of each mapping unit are the capability unit, pasture and hayland group, woodland suitability group, and range site in which the mapping unit has been placed. The page for the description of each pasture and hayland group and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey

Consecutive capital letters in the map symbol indicate the delineations are much larger and the composition of the units is apt to be more variable than other units in the survey area. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

The acreage and proportionate extent of each map-

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Bruno loamy fine sand	2,920	0.7	Mountainburg-Enders association, rolling	2,060	.5
Cane fine sandy loam, 1 to 3 percent slopes	1,050	.2	Mountainburg-Enders association, steep	2,840	.6
Cane fine sandy loam, 3 to 8 percent slopes	8,010	1.9	Mountainburg-Enders association, very steep	1,090	.2
Caspiana silt loam	1,640	.4	Mountainburg-Rock outcrop association, very steep	4,000	.9
Ceda cobbly fine sandy loam	5,140	1.2	Muskogee silt loam, 1 to 3 percent slopes	1,720	.4
Enders gravelly fine sandy loam, 5 to 15 percent slopes	3,090	.7	Nella gravelly fine sandy loam, 1 to 3 percent slopes	2,910	.7
Enders-Mountainburg association, rolling	2,370	.5	Nella gravelly fine sandy loam, 3 to 8 percent slopes	5,700	1.3
Enders-Mountainburg association, steep	2,150	.5	Nella gravelly fine sandy loam, 8 to 12 percent slopes	1,630	.4
Guthrie silt loam	2,850	.7	Nella-Enders association, rolling	16,260	3.8
Leadvale silt loam, 1 to 3 percent slopes	11,540	2.7	Nella-Enders association, steep	54,910	12.8
Leadvale silt loam, 3 to 8 percent slopes	4,160	1.0	Nella-Enders association, very steep	11,120	2.6
Leesburg association, rolling	2,920	.7	Nella-Mountainburg association, rolling	13,440	3.1
Leesburg association, steep	2,590	.6	Nella-Mountainburg association, steep	26,700	6.2
Leesburg-Enders association, steep	2,830	.6	Nella-Mountainburg association, very steep	50,210	11.7
Leesburg-Enders association, very steep	8,410	2.0	Nella soils, rolling	4,790	1.1
Linker fine sandy loam, 1 to 3 percent slopes	4,260	1.0	Nella soils, steep	2,980	.7
Linker fine sandy loam, 3 to 8 percent slopes	47,940	11.1	Pickwick silt loam, 1 to 3 percent slopes	5,750	1.3
Linker fine sandy loam, 8 to 12 percent slopes	1,580	.4	Pickwick silt loam, 3 to 8 percent slopes	9,810	2.3
Linker association, rolling	12,730	3.0	Roellen clay	2,360	.5
Linker-Mountainburg association, rolling	2,250	.5	Spadra fine sandy loam, 1 to 3 percent slopes	13,290	3.1
McKamie silt loam, 3 to 8 percent slopes	1,690	.4	Taft silt loam	4,140	1.0
Moreland clay	710	.2	Udorthents	3,050	.7
Morganfield silt loam	3,160	.7	Water [1]	7,024	1.6
Mountainburg gravelly fine sandy loam, 3 to 12 percent slopes	25,950	6.0	Total	430,464	100.0
Mountainburg stony fine sandy loam, 1 to 12 percent slopes	14,480	3.4			
Mountainburg stony fine sandy loam, 12 to 65 percent slopes	6,260	1.4			

[1] Includes only bodies of water of less than 40 acres and streams less than one-eighth mile wide.

roots; few pores; common bedding planes; neutral; gradual smooth boundary.

C2—28 to 45 inches, brown (7.5YR 5/4) loamy very fine sand; single grained; loose; few fine roots; few pores; common bedding planes; netural; abrupt wavy boundary.

C3—45 to 72 inches; light yellowish brown (10YR 6/4) fine sand with thin lenses of brown (7.5YR 5/4) loamy fine sand; single grained; loose; common bedding planes; neutral.

The A horizon is brown or yellowish brown. The C horizon is stratified brown, yellowish brown, or light yellowish brown loamy fine sand, loamy very fine sand, or fine sand. These layers are in different sequences in different profiles. Reaction is slightly acid to neutral throughout the profile.

Bruno soils are associated with Morganfield soils. They are more sandy and more rapidly drained than Morganfield soils.

Br—Bruno loamy fine sand. This level and nearly level soil is on young natural levees along the Arkansas River. Slopes are 0 to 3 percent. Areas range from about 50 to 250 acres in size. Included in mapping are a few areas of Caspiana and Morganfield soils.

This soil is poorly suited to farming. Available water capacity is low, and droughtiness is a severe limitation. Some areas are subject to occasional flooding. The hazard of soil blowing is severe in spring if the soil is left bare. Clean-tilled crops that leave a large amount of residue can be safely grown year after year if management is good.

These soils are used mainly for forage crops. Winter small grains can be grown, but establishing a stand is often difficult. Also, the crop is damaged in places by lack of moisture. Soybeans and other clean-tilled, warm-season crops are poorly suited to but are grown in some areas (fig. 3). Adapted forage plants are bermudagrass, weeping lovegrass, johnsongrass, and crimson clover. Capability unit IIIs–1; pasture and hayland group 3B; woodland suitability group 2s5; not assigned to a range site.

Cane Series

The Cane series consists of moderately well drained, nearly level and gently sloping soils on colluvial foot slopes and old stream terraces in broad valleys. These soils formed in loamy sediment washed from uplands of weathered sandstone and shale. The native vegetation was mainly mixed hardwood trees and some pines.

In a representative profile the surface layer is brown fine sandy loam about 5 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 6 inches is yellowish red, friable loam; the next 9 inches is yellowish red, friable clay loam; and the next 39 inches is a firm, brittle fragipan. The upper 20 inches of the fragipan is yellowish red, mottled clay loam, and the lower 19 inches is mottled sandy clay loam. Mottled, friable sandy clay loam is below the fragipan.

Cane soils are low in natural fertility. Permeability is slow, and the available water capacity is medium. The firm, brittle fragipan in the subsoil restricts the penetration of roots and slows the movement of water through the soil. These soils respond well to fertilization.

Most areas of Cane soils are cleared and were culti-

Figure 3.—**Poor stand of soybeans on Bruno loamy fine sand. (Good stand in background is on Morganfield silt loam.)**

vated in the past, but they are now used as pasture and meadow. They are easy to till and can be culti-

lowish brown (10YR 5/8), and yellowish red (5YR 5/6) sandy clay loam; weak medium subangular

soils that have a gravelly surface layer and a few areas of Leadvale, Pickwick, and Taft soils.

This soil is suited to farming, but the hazard of erosion is moderate. Clean-tilled crops that leave a large amount of residue can be safely grown year after year if management is good and includes contour cultiva-

subject to occasional flooding in winter, but this does not seriously limit their use for farming. These soils are easy to till and can be cultivated throughout a wide range of moisture content.

Representative profile of Caspiana silt loam in a moist cultivated area in the SW¼NW¼NW¼ sec. 32.

grown without attention to row direction.

This soil is used mainly as pasture or meadow. It is suited to such crops as soybeans, grain sorghum, winter small grains, and truck crops. Peaches and grapes are also grown in a few areas. Adapted pasture plants are bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza.

Ap—0 to 10 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; friable; many fine roots; few pores; slightly acid; abrupt smooth boundary.

B21t—10 to 24 inches; dark brown (7.5YR 3/2) silty clay loam; weak fine subangular blocky structure; friable; common patchy clay films on faces of peds; common fine roots; few fine pores; slightly acid;

nearly level soils on flood plains of small streams in narrow valleys. These soils formed in cobbly, loamy sediment washed from uplands of weathered sand-

ridges. These soils formed in a thin layer of loamy material and the underlying clayey material that has weathered from shale. The native vegetation was

many medium distinct strong brown (7.5YR 5/8) and yellowish brown (10YR 5/8) and few medium prominent dark red (2.5YR 3/6) mottles; massive to weak thin platy structure relict of shale beds; firm; about 75 percent soft weathered black shale; very strongly acid.

The A1 horizon is very dark grayish brown to dark brown fine sandy loam or gravelly fine sandy loam. Some profiles have an A2 horizon, 3 to 6 inches thick, that is brown or yellowish brown and has the same range of textures as the A1 horizon.

The B1 horizon is reddish brown to strong brown loam, gravelly loam, clay loam, or sandy clay loam. In many profiles the A and B1 horizons are stony. The B21t horizon is yellowish red or red clay loam, clay, or silty clay. The B22t and B3 horizons are silty clay or clay.

The A horizon is 15 to 35 percent sandstone, and the B1 and B21t horizons are as much as 10 percent sandstone. Shale fragments are few to common throughout the profile and make up 10 to 60 percent of the B3 and C horizons. Depth to shale bedrock ranges from about 42 to 96 inches. Reaction is strongly acid or very strongly acid throughout the profile.

Enders soils are associated with Cane, Leadvale, Leesburg, Linker, Mountainburg, and Nella soils. They are more clayey in the B2t horizon than any of the associated soils, and they are underlain by shale rather than by the sandstone of Linker and Mountainburg soils. Enders soils are deeper to bedrock than Linker and Mountainburg soils. They do not have the fragipan characteristic of Cane and Leadvale soils.

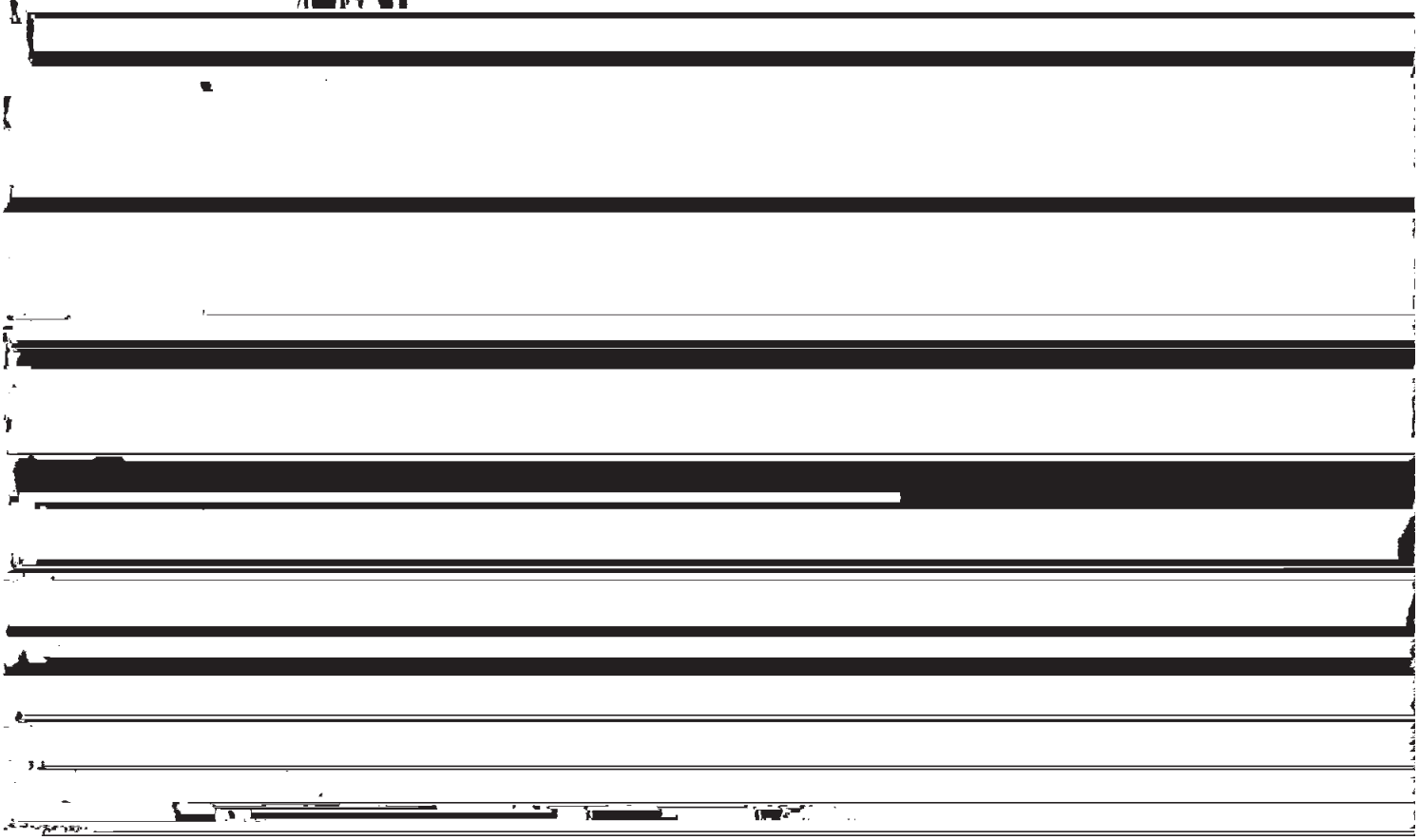
EnD—Enders gravelly fine sandy loam, 5 to 15 percent slopes. This gently sloping to moderately steep soil is on crests and toe slopes of ridges and hills. Areas range from about 10 to 100 acres in size. The profile of this soil is similar to the one described as representative for the series except the surface layer is gravelly. Included in mapping are a few areas of

face layer is gravelly in some areas. Mountainburg soils have a profile similar to the one described as representative for the Mountainburg series, but in places they are stony throughout their profile.

Runoff is rapid, and the hazard of erosion is very severe on these soils. They are not suited to cultivated crops, and they are poorly suited to pasture. The soils are better suited to wildlife habitat or woodland than to other uses. This association has moderate wood producing potential. A few small areas are used as pasture and range. Surface stones and slopes limit pasture management. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza. Enders soils in Capability unit VIIs–2; pasture and hayland group 8D; woodland suitability group 4x2; and Clay Break, Shale range site. Mountainburg soils in Capability unit VIIs–3; pasture and hayland group 14B; woodland suitability group 5x3; and Sandstone Ridge range site.

EME—Enders-Mountainburg association, steep. The soils in this association are on hillsides and mountainsides. Slope ranges from 20 to 40 percent. The individual soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally are in a regular pattern and are in about the same relative proportions.

This association is about 45 to 65 percent Enders fine sandy loam that is gravelly or stony in most areas and 25 to 45 percent Mountainburg gravelly or stony fine sandy loam. The rest of the association is small areas of Leesburg, Linker, and Nella soils and Rock



grayish brown silt loam about 6 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 9 inches is light [redacted] silt loam, and the

zon, strongly acid or very strongly acid in the B1g through the Bx2 horizons, and slightly acid to strongly acid in the Bx3 and C horizons.

[redacted]

weak fine subangular blocky structure; friable; many fine roots; few pores; medium acid; clear

LeC—Leadvale silt loam, 3 to 8 percent slopes. This

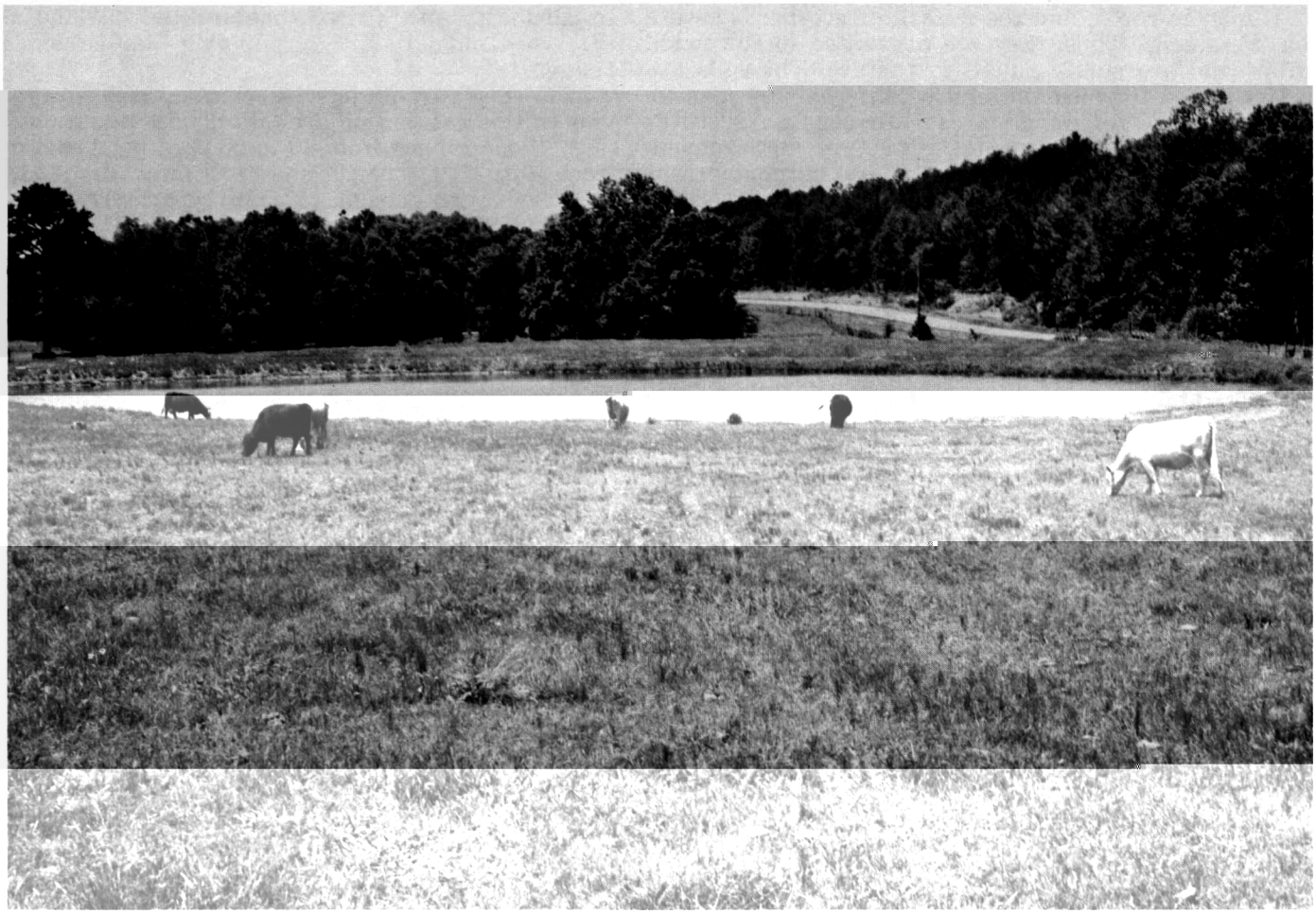


Figure 4.—**Bermudagrass pasture and farm pond on Leadvale silt loam, 1 to 3 percent slopes.**

structure; friable; common patchy clay films on faces of peds; common fine and medium roots; common fine pores; about 15 percent sandstone fragments as much as 3 inches in diameter; strongly acid; gradual smooth boundary.

B22t—20 to 36 inches; strong brown (7.5YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; common fine and medium roots; common fine pores; about 15 percent sandstone fragments as much as 3 inches in diameter;

is yellowish brown or strong brown gravelly loam, gravelly clay loam, or gravelly sandy clay loam. Mottling is not present in the B23t and B24t horizons of many profiles.

Content of coarse fragments ranges from 15 to 35 percent of the A horizon; 10 to 25 percent of the B1, B21t, and B22t horizons; and 10 to 50 percent of the B23t and B24t horizons. Depth to bedrock is 72 inches or more. Reaction is medium acid or strongly acid in the A horizon and medium acid to very strongly acid in the B horizon.

Leesburg soils are associated with Enders, Mountainburg, and Nella soils. They have less clay in the B2t hori-

Runoff is rapid, and the hazard of erosion is severe on these soils. Thus, they are not suited to cultivated crops and are poorly suited to pasture. The soils are better suited to woodland and wildlife habitat than to other uses. A few small areas are used as pasture. Surface stones and slope make pasture management difficult. Adapted pasture plants are bermudagrass, [redacted] in capability unit VIIs–2; pasture and hayland group 8D; woodland suitability group 4x2; Clay Break, Shale range site.

LEF—Leesburg-Enders association, very steep. The soils in this association are on hillsides and mountainsides. Slope ranges from 40 to 65 percent. Areas range from 50 to 500 acres in size. The individual soils are in areas large enough to map separately, but they [redacted]

O1—2 inches to 1; loose litter of pine needles, hardwood leaves and twigs.
O2—1 inch to 0; partially decayed organic debris.
Ap—0 to 6 inches; dark brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure parting to moderate fine granular; friable; about 5 percent sandstone fragments as much as 3

LnC—Linker fine sandy loam, 3 to 8 percent slopes. This gently sloping soil is on hilltops, hillsides, and benches. Areas range from about 5 to 200 acres in size. This soil has the profile described as representative for the series. Included in mapping are areas of Enders and Mountainburg soils and a few areas of

Figure 5.—**Peach orchard on Linker fine sandy loam, 3 to 8 percent slopes.**

The soils of this association are better suited to pasture, woodland, or wildlife habitat than they are to

the benches and scattered over the hilltops and mountaintops where the bedrock is at a greater depth.

McKamie Series

The McKamie series consists of well drained, gently sloping soils on high terraces along the Arkansas River. These soils formed in loamy and clayey sediment brought in by the Arkansas River from the prairies and mountains to the west. The native vegetation was chiefly mixed hardwood trees and some pines.

In a representative profile the surface layer is dark

B1 horizons, strongly acid or very strongly acid in the B2t horizon, and very strongly acid to mildly alkaline in the IIB3 horizon.

McKamie soils are associated with Muskogee soils. They are redder and have more clay in the upper part of the B horizon than Muskogee soils.

McC—McKamie silt loam, 3 to 8 percent slopes. This soil is on high terraces along the Arkansas River. Areas range from about 50 to 200 acres in size.

common slickensides; neutral; clear wavy boundary.

B3—51 to 72 inches; reddish brown (5YR 4/4) clay loam; moderate medium subangular blocky structure; friable; few fine roots; few pores; neutral.

The A horizon is dark brown or dark reddish brown. The upper 24 to 42 inches of the B horizon is dark brown to dark reddish-brown silty clay or clay. The lower part of the B horizon is dark reddish-brown to reddish-brown silty clay, silty clay loam, or clay loam. Reaction ranges from slightly acid to mildly alkaline throughout the profile. The soil is calcareous in some layers between depths of 8 and 36 inches.

Moreland soils are associated with Caspiana, Morganfield, and Roellen soils. They contain more clay and less sand and silt than Caspiana and Morganfield soils. They are browner below the surface layer and are better drained than Roellen soils.

winter flooding in some areas. Adapted pasture plants include bermudagrass, bahiagrass, tall fescue, and white clover. Capability unit IIw–1; pasture and hayland group 1A; woodland suitability group 2w6; not assigned to a range site.

Morganfield Series

The Morganfield series consists of well drained, level and nearly level soils on natural levees along the Arkansas River. These soils formed in loamy sediment of mixed origin brought in from the west by the Arkansas River. The native vegetation was hardwood trees.

In a representative profile the surface layer is silt

They contain more sand and silt and less clay than Moreland soils.

Mg—Morganfield silt loam. This soil is on natural levees along the Arkansas River. Slope ranges from 0 to 2 percent. Some areas are gently undulating and have alternating swales and low ridges. Areas range from about 40 to 800 acres in size. Included in mapping are a few areas of Bruno, Caspiana, and Moreland soils.

This soil is well suited to cultivated crops (fig. 7) and is easy to till. Clean-tilled crops that leave a large amount of residue can be safely grown year after year

Mountainburg Series

The Mountainburg series consists of well drained, gently sloping to very steep soils on benches and on tops and sides of hills, ridges, and mountains. These soils formed in loamy material weathered from sandstone. The native vegetation is chiefly mixed hardwood trees, pines, and an understory of tall grasses.

In a representative profile the surface layer is dark brown gravelly fine sandy loam about 3 inches thick. The upper part of the subsoil is yellowish red gravelly sandy clay loam about 6 inches thick, and the lower

ment. These soils are better suited to pasture or range, woodland, or wildlife habitat than to other uses. Most of the area is woodland and savanna of poor quality. Some of the acreage is in pasture and orchards.

Representative profile of Mountainburg gravelly fine sandy loam, 3 to 12 percent slopes, in a moist wooded area in the NW¼NW¼NW¼ sec. 30, T. 11 N., R. 22 W.:

O1—1 inch to 0; litter of pine needles and hardwood leaves and twigs.

Ap—0 to 3 inches; dark brown (7.5YR 4/4) gravelly fine sandy loam; moderate fine granular structure; very friable; common fine and medium roots; few fine pores; about 15 percent angular sandstone fragments as much as 4 inches in diameter;

120 acres in size. This soil has a profile similar to the one described as representative for the series except the surface layer is stony. Included in mapping are a few areas of Enders and Linker soils and Rock outcrop.

This soil is not suited to cultivated crops, and it is poorly suited to improved pasture. Surface stones and rock outcrops limit the use of farm equipment (fig. 8), and the soil is droughty. Thus, this soil is better suited to range or wildlife habitat than to other uses. Most of this soil is wooded with trees of poor quality. Capability unit VIs–1; pasture and hayland group 14C; woodland suitability group 5x3; Sandstone Ridge range site.

mountains. Slope ranges from 8 to 20 percent. The individual soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally are in a regular pattern and are in about the same relative proportions.

This association is 45 to 60 percent Mountainburg gravelly or stony fine sandy loam and 30 to 45 percent Enders fine sandy loam that is gravelly or stony in most areas. The rest of the association is small areas of Leesburg, Linker, and Nella soils and Rock outcrop.

Mountainburg soils are on narrow sandstone ledges and benches. Enders soils are on slopes between sandstone ledges or benches and on foot slopes. Areas range from about 50 to 200 acres in size. Mountainburg soils have a profile similar to the one described as representative for the Mountainburg series except they are stony in some areas. Enders soils have a profile similar to the one described as representative for the Enders series except the surface layer is gravelly or stony in most places.

Runoff is rapid, and the hazard of erosion is very severe on these soils. They are not suited to cultivated crops, and they are poorly suited to pasture. Surface vated crops. The soils are better suited to wildlife habitat or woodland than they are to other uses. This association has a low wood producing potential. Mountainburg soils in capability unit VIIs–3; pasture and hayland group 14B; woodland suitability group 5x3; Sandstone Ridge range site. Enders soils in capability unit VIIs–2; pasture and hayland group 8D; woodland suitability group 4x2; Clay Break, Shale range site.

MEF—Mountainburg-Enders association, very steep. The soils in this association are on hillsides and mountainsides. Slope ranges from 40 to 65 percent. The individual soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally are in a regular pattern and in about the same relative proportions.

This association is 50 to 65 percent Mountainburg gravelly or stony fine sandy loam and 30 to 45 percent Enders gravelly or stony fine sandy loam. The rest of the association is small areas of Leesburg, Linker, and Nella soils and Rock outcrop.

Mountainburg soils are on narrow sandstone ledges and benches. Enders soils are on side slopes between sandstone ledges or benches and on foot slopes. Areas range from 60 to 500 acres in size. Mountainburg soils

wildlife habitat or woodland than they are to other

B23t, and B24t horizons are mottled light gray, strong brown, and red, or they are light gray, yellowish brown

sandy loam; weak medium granular structure; very friable; many fine and medium roots; common fine pores; about 30 percent sandstone fragments as much as 3 inches in diameter; medium acid; clear wavy boundary.

A2—3 to 7 inches; brown (10YR 4/3) gravelly fine sandy loam; weak fine subangular blocky structure; friable; many fine and medium roots; common fine pores; about 20 percent sandstone fragments as much as 3 inches in diameter; medium acid; abrupt smooth boundary.

B1—7 to 16 inches; reddish brown (5YR 4/4) gravelly sandy clay loam; weak fine subangular blocky structure; friable; common patchy clay films on faces of peds; common fine roots; common fine pores; about 25 percent sandstone fragments as much as 20 inches in diameter; medium acid; clear wavy boundary.

B21t—16 to 29 inches; yellowish red (5YR 4/6) gravelly clay loam; weak medium subangular blocky structure; friable; common patchy clay films on faces of peds; common fine roots; common fine pores; about 20 percent sandstone fragments as much as 20 inches in diameter; medium acid; clear smooth boundary.

B22t—29 to 36 inches; red (2.5YR 4/8) gravelly clay loam; weak medium subangular blocky structure; friable; many patchy clay films on faces of peds; few fine roots; few fine pores; about 15 percent sandstone fragments as much as 3 inches in diameter; medium acid; clear smooth boundary.

B23t—36 to 44 inches; red (2.5YR 4/6) gravelly clay loam; moderate medium subangular blocky structure; friable; continuous clay films on faces of peds; few fine roots; few fine pores; about 25 percent sandstone fragments as much as 3 inches in diameter; very strongly acid; gradual smooth boundary.

B24t—44 to 54 inches; red (2.5YR 4/6) gravelly clay loam; few fine faint yellowish red mottles; moderate fine subangular blocky structure; friable; continuous clay films on faces of peds; few fine roots; few fine pores; about 15 percent sandstone fragments as much as 3 inches in diameter; very strongly acid; abrupt irregular boundary.

B25t—54 to 72 inches; red (2.5YR 4/6) clay loam; common fine faint dark red and yellowish red mottles; moderate fine subangular blocky structure; friable continuous clay films on faces of peds; few fine roots; few fine pores; about 50 percent sandstone fragments 10 to 24 inches in diameter; strongly acid.

The A1 horizon is gravelly or stony fine sandy loam. The A2 horizon is brown to very dark grayish brown. Some profiles have an Ap horizon 5 to 8 inches thick. It is brown or dark brown.

The B1 horizon is brown to yellowish red gravelly loam or gravelly sandy clay loam. The B2t horizons are yellowish red to dark red sandy clay loam or clay loam that is gravelly or stony in many profiles. Some profiles contain mottles in the lower part.

The A horizon is 15 to 35 percent coarse fragments, and the B1 horizon and upper part of the B2t horizons are 10 to 25 percent coarse fragments. The lower part of the B2t horizon is 10 to 50 percent coarse fragments. Depth to bedrock is more than 72 inches. Reaction is medium acid or

from 100 to 200 acres in size. Included in mapping are a few areas of Pickwick soils.

Although runoff is medium and the hazard of erosion is moderate on this soil, it is suited to cultivated crops. Tilled crops that leave large amounts of residue can be safely grown year after year if good management that includes contour cultivation and terracing on long slopes is used. Gravel in the surface layer makes tillage difficult.

This soil is well suited to pasture, wildlife habitat, and woodland, and most areas are used for these purposes. Suitable crops include corn and winter small grains. Grapes and peaches are also grown in some areas. Adapted pasture plants are bermudagrass, tall fescue, bahiagrass, annual lespedeza, and sericea lespedeza. Capability unit IIe–1; pasture and hayland group 8A; woodland suitability group 3o7; not assigned to a range site.

NaC—Nella gravelly fine sandy loam, 3 to 8 percent slopes. This soil is on stream terraces, foot slopes, and benches. Areas range from 10 to 200 acres in size. Included in mapping are a few areas of Enders, Linker, Mountainburg, and Pickwick soils.

Although runoff is medium and the hazard of erosion is severe on this soil, it is suited to cultivated crops. Tilled crops that leave large amounts of residue can be grown year after year on the less sloping soils when good management that includes contour cultivation and terraces is used. Conservation treatments need to be intensified where slopes are longer and slope more than most. Gravel in the surface layer makes tillage difficult.

This soil is better suited to pasture, wildlife habitat, and woodland than it is to other uses, and most areas are used for these purposes. Suitable crops include corn and winter small grains. Grapes and peaches are also grown in some areas. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza. Capability unit IIIe–1; pasture and hayland group 8A; woodland suitability group 3o7; not assigned to a range site.

NaD—Nella gravelly fine sandy loam, 8 to 12 percent slopes. This soil is on stream terraces and foot slopes. Areas range from 10 to 100 acres in size. Included in mapping are a few areas of Enders, Linker, Mountainburg, and Pickwick soils.

Runoff is rapid, and the hazard of erosion is very severe on this soil. Thus, it is poorly suited to cultivated crops. Gravel in the surface layer limits tillage. Sown crops can be safely grown occasionally in a cropping system that includes close-growing cover most of the time.

This soil is better suited to pasture, wildlife habitat,

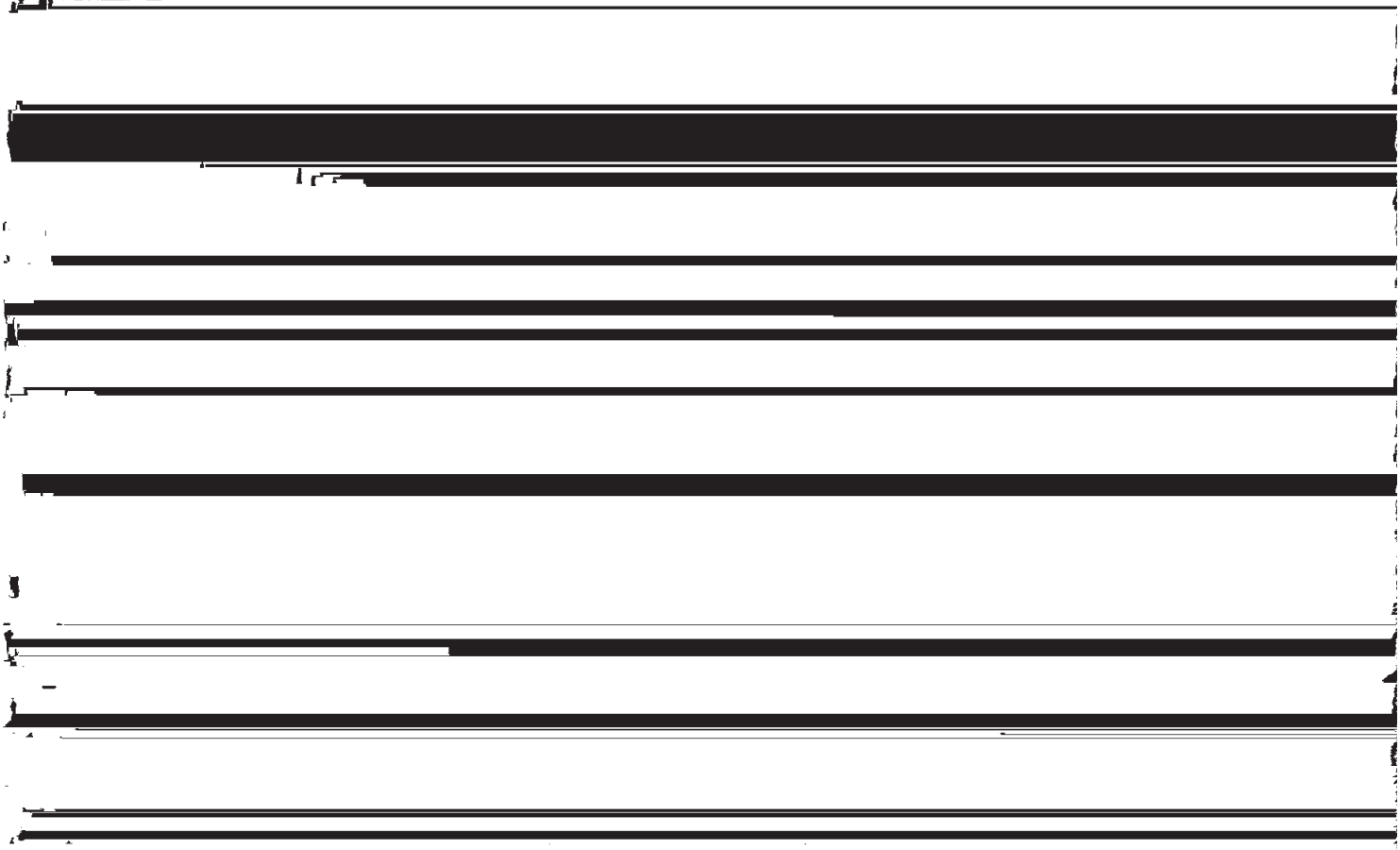
Slope ranges from 8 to 20 percent. Areas range from 50 to 500 acres in size. The individual soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally are in a regular pattern and in about the same relative proportions.

This association is about 50 to 70 percent Nella gravelly or stony fine sandy loam, and 20 to 45 percent Enders gravelly or stony fine sandy loam. The rest of the association is small areas of Leesburg, Linker, and Mountainburg soils and Rock outcrop.

Nella soils are on foot slopes and benches. Enders soils are on side slopes and benches. Nella soils have a profile similar to the one described as representative for the Nella series except the surface layer is stony in many areas. One of the Enders soils has the profile

hayland group 8D; woodland suitability group 4x2; Clay Break, Shale range site.

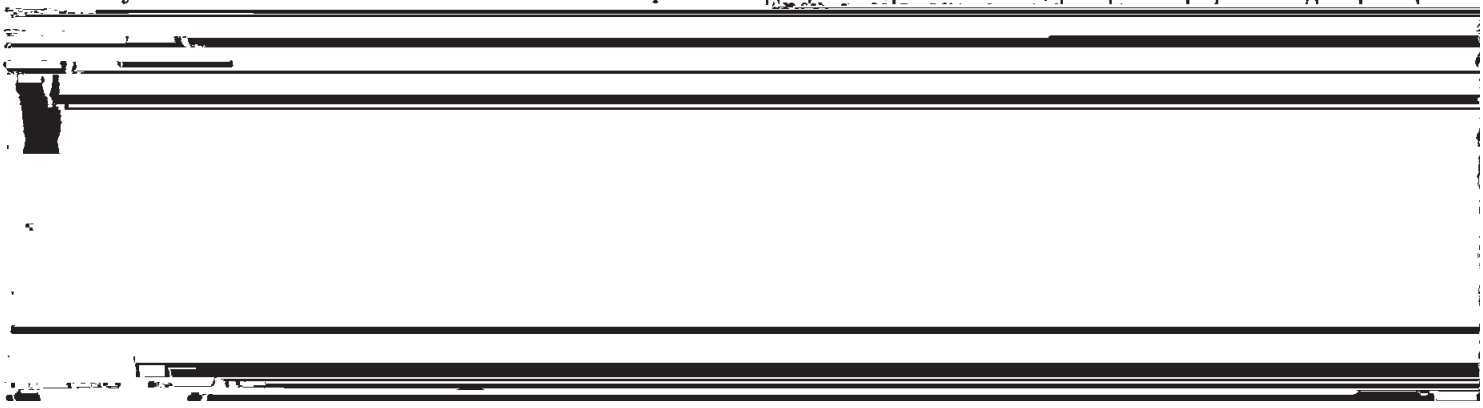
NEF—Nella-Enders association, very steep. The soils in this association are on hillsides and mountainsides. Slope ranges from 40 to 60 percent. Areas range from



areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally are in a regular pattern and in about the same relative proportions.

This association is about 40 to 60 percent Nella stony or gravelly fine sandy loam and 30 to 50 percent Enders gravelly or stony fine sandy loam. The rest of the association is small areas of Leesburg and Mountainburg soils and Rock outcrop.

Nella soils are on benches, foot slopes, and in coves.



assigned to a range site. Mountainburg soils in Capability unit VIIs–3; pasture and hayland group 14B; woodland suitability group 5d2; Sandstone Ridge range site.

NME—Nella-Mountainburg association, steep. The soils in this association are on hilltops and mountainsides. Slope ranges from 20 to 40 percent. Areas range from 50 to 500 acres in size. The individual soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use. The soils generally are in a regular pattern and are in about the same relative proportions.

This association is 45 to 65 percent Nella gravelly or stony fine sandy loam and 20 to 40 percent Mountainburg gravelly or stony fine sandy loam. The rest of the association is small areas of Enders, Leesburg, and Linker soils and Rock outcrop.

Nella soils are on foot slopes and benches. Mountainburg soils are on slope breaks and ridgetops. Nella

assigned to a range site. Mountainburg soils in Capability unit VIIs–3; pasture and hayland group 14B; woodland suitability group 5x3; Sandstone Ridge range site.

NSD—Nella soils, rolling. The soils in this undifferentiated group are on benches and foot slopes. Slopes range from 8 to 20 percent. Areas range from 50 to 200 acres in size. These Nella soils are in areas large enough to map separately, but they were not separated because of poor accessibility and low intensity of use.

This mapping unit is about 10 to 50 percent Nella stony fine sandy loam, 10 to 50 percent Nella gravelly fine sandy loam, and 20 to 60 percent Nella fine sandy loam. The rest of the mapping unit is small areas of Enders, Leesburg, and Mountainburg soils and Rock outcrop.

These soils are used as woodland, and management requirements are not greatly different for the several phases. Generally, the stony and gravelly soils are

Pickwick Series

The Pickwick series consists of well drained, nearly level to gently sloping soils on stream terraces. These soils formed in alluvium washed from uplands of weathered sandstone and shale. The native vegetation was mainly hardwood trees and some pines.

In a representative profile the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 72 inches or more. The upper 6 inches is yellowish red loam; the next 23 inches is red silty clay loam; the next 17 inches is dark red silty clay loam; and the lower 20 inches is dark red, mottled silty clay loam.

Pickwick soils are moderate to low in natural fertility. Permeability is moderate, and the available water capacity is high. These soils respond well to fertilization.

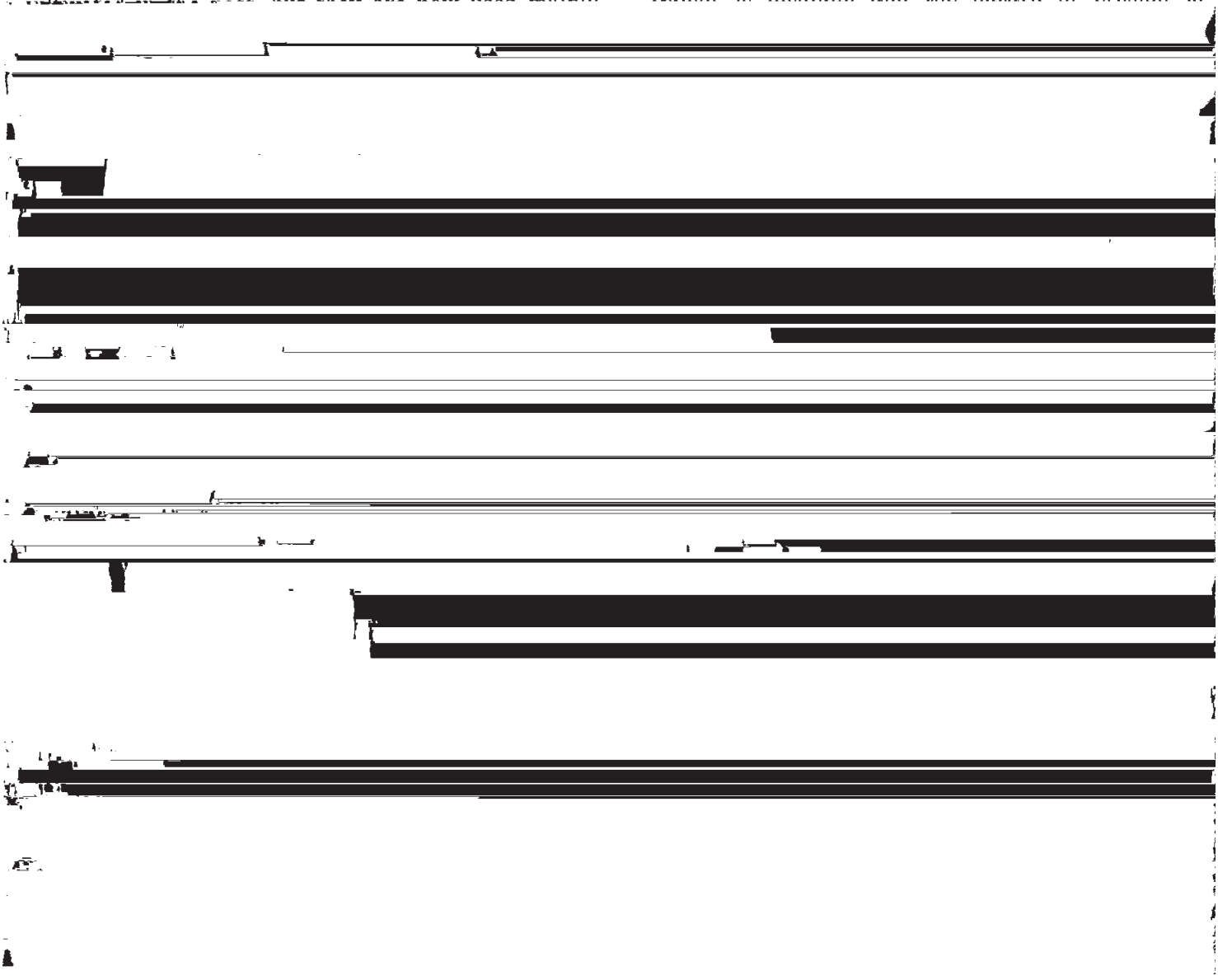
Pickwick soils are suited to cultivated crops when erosion is controlled. Most areas are cleared and were [illegible] but they are now used mainly [illegible]

leave a large amount of residue can be safely grown year after year if management is good and includes contour cultivation and terracing on long slopes. Sown crops can be grown without attention to row direction.

This soil is used mainly as pasture or meadow. It is suited to such crops as soybeans, grain sorghum, winter small grains, truck crops, peaches, and grapes, and these are grown in a few areas. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Capability unit IIe–1; pasture and hayland group 8A; woodland suitability group 3o7; not assigned to a range site.

PcC—Pickwick silt loam, 3 to 8 percent slopes. This soil is on stream terraces. Areas range from about 10 to 400 acres in size. This soil has the profile described as representative for the series. Included in mapping are a few areas of Cane, Leadvale, and Nella soils and a few small areas of soils that have a gravelly surface layer.

Runoff is medium, and the hazard of erosion is



extends to a depth of 72 inches or more. The upper 8 inches is very dark gray, mottled clay; the next 21 inches is dark gray, mottled clay; and the lower 35 inches is dark grayish brown, mottled clay.

Roellen soils are high in natural fertility. Permeability is slow, and the available water capacity is high. These soils respond well to fertilization.

These soils are suited to most crops grown in the county if they are adequately drained. Most of the acreage is cultivated. Some of these soils are subject to occasional flooding in winter, but this does not seriously limit their use for farming. Clods form and the soils are difficult to till if they are plowed when too wet. They shrink and crack when dry, and when wet, they expand and the cracks seal.

Representative profile of Roellen clay in a moist field in the SW¼SE¼NW¼ sec. 18, T. 9 N., R. 23 W:

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay, weak fine granular structure; firm; plastic; many fine roots; few pores; slightly acid; abrupt smooth boundary.

B21g—8 to 16 inches; very dark gray (10YR 3/1) clay; few fine faint dark yellowish brown mottles; moderate medium angular blocky structure; firm; very plastic; common fine roots; few pores; many slickensides; common pressure faces; slightly acid; gradual smooth boundary.

B22g—16 to 37 inches; dark gray (10YR 4/1) clay; common fine faint dark yellowish brown mottles; moderate medium angular blocky structure; firm; very plastic; few fine roots; few pores; many slickensides; common pressure faces; slightly acid; gradual smooth boundary.

B23—37 to 63 inches; dark grayish brown (10YR 4/2) clay, common fine faint dark yellowish brown mottles; moderate medium angular blocky structure; firm; very plastic; many slickensides; common pressure faces; neutral; clear wavy boundary.

B3—63 to 72 inches; dark grayish brown (10YR 4/2) clay; common fine faint dark yellowish brown mottles; weak medium angular blocky structure; firm; very plastic; common slickensides; common pressure faces; mildly alkaline.

The A horizon is very dark gray or very dark grayish brown. The B2g horizon is very dark gray or dark gray. The B23 and B3 horizons are dark gray to dark grayish brown. Reaction ranges from medium acid to neutral in the A horizon and from slightly acid to mildly alkaline in the B horizon.

Roellen soils are associated with Caspiana and Moreland soils. They are grayer than either of these soils and contain more clay than Caspiana soils.

Ro—Roellen clay. This soil is in slack-water areas of the flood plain of the Arkansas River. Slope is less than 1 percent. Areas are about 30 to 500 acres in

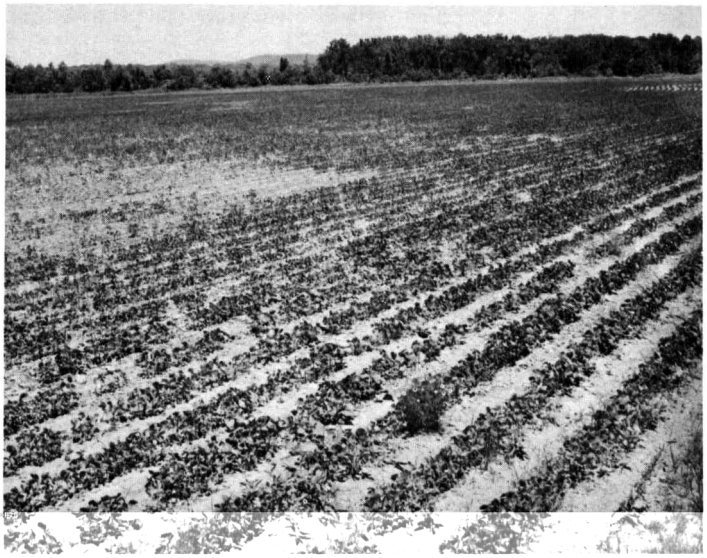


Figure 9.—**Stand of soybeans on Roellen Clay, which has poor surface drainage.**

tall fescue, and white clover. Capability unit IIIw–1; pasture and hayland group 1A; woodland suitability group 2w6; not assigned to a range site.

Spadra Series

The Spadra series consists of well drained, nearly level soils on low stream terraces along the larger upland streams. These soils formed in alluvium washed from uplands derived from weathered sandstone and shale. The native vegetation was mainly hardwoods with some pine trees.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of 55 inches. The upper 13 inches is yellowish red sandy clay loam; the next 18 inches is reddish brown sandy clay loam; and the lower 16 inches is reddish brown fine sandy loam. The underlying material is reddish brown fine sandy loam.

Spadra soils are moderate in natural fertility. Permeability is moderate, and the available water capacity is medium. These soils respond well to fertilization.

Most areas of these soils are subject to occasional flooding. Nearly all areas have been cleared and are

B22t—21 to 39 inches; reddish brown (5YR 4/4) sandy clay loam; weak fine subangular blocky structure; friable; common patchy clay films on faces of peds; few fine roots; few pores; strongly acid; gradual smooth boundary.

B3—39 to 55 inches; reddish brown (5YR 4/4) fine sandy

inches is a firm, brittle fragipan. The upper inch of the fragipan is light gray silt loam, and the lower 20 inches is mottled light gray, yellowish brown, and red silty clay loam. The lower 32 inches of the subsoil is mottled light gray and yellowish brown, firm silty

rounded mounds and areas of Cane, Guthrie, and Leadvale soils.

Runoff is slow, and excessive water is a severe limitation on this soil. It is suited to cultivated crops if it is drained and well managed. Farming is delayed several days after a rain unless surface drains are installed. Clean tilled crops that leave a large amount of residue can be safely grown year after year if management is good and includes adequate drainage.

This soil is used mainly as pasture and meadow. Among the suitable crops are soybeans and grain sorghum. Winter small grains can be grown if surface drainage is adequate. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Capability unit IIIw–2; pasture and hayland group 8F; woodland suitability group 3w8; not assigned to a range site.

Udorthents

Ud—Udorthents. This unit consists of mixed shale, sandstone, and soil material of the original mantle. This material has been stripped from coal beds.

In mining operations the removal of material overlying the coal has left long pits and ridges and piles of excavated material.

Slopes are steep, runoff is rapid, and the hazard of erosion is very severe. A few small areas have been

orchards, vineyards, and truck farms, all of which are important agricultural enterprises in the county. A small acreage is used for row crops.

In general, the soils in this county are low in nitrogen, potassium, phosphorus, calcium, and organic matter. Many of those suited to cultivated crops are erodible. Poor surface or internal drainage are limitations on some soils. Many soils are poorly suited or unsuited to intensive use because of stony conditions, shallow depth to bedrock, high content of coarse fragments within the soil, or combinations of these features.

Contour cultivation, vegetated waterways, and terraces in many fields are needed on sloping soils that are used for tilled crops. Row arrangement and surface drains are needed for dependable growth on wet areas.

Annual cover crops or grasses and legumes should be grown regularly in the cropping system if the hazard of erosion is severe or if the crops that are grown leave only small amounts of residue. Crop residue should be shredded and spread evenly to provide protective cover and active organic matter to the soils. Minimum tillage should be practiced to the extent practical for the soil conditions and the crop requirements.

The kinds and amounts of fertilizer and lime applied are generally based on soil tests, kinds of

In the capability system, all kinds of soil are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be up to 4 subclasses. The subclasses are indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage) ; *s* shows that the soil is limited mainly because it is shallow, droughty, or stormy; and *c* indicates that the chief limitation is climate that is too cold or too dry.

In class I here are no subclasses because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c* because the soils are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, or wildlife.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, that they require about the same management, and that they have generally similar productivity and other responses to management. Capability units are generally identified by numbers assigned

Subclass IIIe. Soils subject to severe erosion if they are cultivated and are not protected.
- Unit IIIe–1. Gently sloping, moderately well drained and well drained, moderately deep and deep, loamy soils on uplands.

Subclass IIIw. Soils severely limited for cultivated crops because of excess water.
- Unit IIIw–1. Level, poorly drained, deep, clayey soils on bottom lands.
- Unit IIIw–2. Level, somewhat poorly drained, deep, loamy soils on uplands.

Subclass IIIs. Soils severely limited because of low available water capacity.
- Unit IIIs–1. Level and nearly level, excessively drained, deep, stratified, sandy soils on bottom lands.

Class IV. Soils having very severe limitations that reduce the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to very severe erosion if they are cultivated and are not protected.
- Unit IVe–1. Moderately sloping, well drained, deep and moderately deep, loamy soils on uplands.
- Unit IVe–2. Gently sloping, well drained, deep, loamy soils that have a clayey subsoil, on uplands.
- Unit IVe–3. Gently sloping and moderately sloping, well drained, shallow, loamy soils on uplands.

Subclass IVw. Soils very severely limited for cultivated crops because of excess water.
- Unit IVw–1. Level to depressional, poorly drained, deep, loamy soils on uplands.

Class V. (None in Johnson County.) Soils having

Subclass VIIe. Soils very severely limited, chiefly by the hazard of erosion, unless protective cover is maintained.
Unit VIIe–1. Steep and very steep, well drained, deep, loamy soils on uplands.
Subclass VIIs. Soils very severely limited, mainly by low available water capacity and stones.
Unit VIIs–1. Level and nearly level, well drained, deep, cobbly, loamy soils on flood plains of small streams that are subject to frequent flooding.
Unit VIIs–2. Moderately sloping to very steep, well drained, deep, stony and loamy soils that have a clayey subsoil, on uplands.
Unit VIIs–3. Moderately sloping to very steep, well drained, shallow, stony and loamy soils on uplands.
Unit VIIs–4. Steep to very steep, well drained, deep, loamy and stony soils on uplands.
Class VIII. Soils and landforms having limitations that preclude their use for commercial crop produc-

group is described. Those who wish to know the pasture and hayland group of a soil can refer to the "Guide to Mapping Units" at the back of this survey. Those desiring more detailed information about the management of soils for these uses can refer to the section "Descriptions of the Soils."

A large part of the cleared land in Johnson County is used as pasture and hayland. Perennial grasses or legumes or mixtures of these are grown for pasture and hay. The mixtures generally consist of either a

and a suitable legume.

Coastal bermudagrass, common bermudagrass, and bahiagrass are the summer perennials most commonly grown. Coastal bermudagrass and bahiagrass are fairly new to the county, but both are highly satisfactory in production of good-quality forage. Johnsongrass is also suited to many of the soils in the county. Tall fescue is the main winter perennial grass grown in the county. All of these grasses respond well to fertilizers and particularly well to nitrogen.

White clover, alfalfa, vetch, crimson clover, annual

TABLE 2.—*Predicted average yields per acre of principal crops under an improved level of management*

[Absence of a figure indicates the crop is not suited or is not commonly grown]

Soil	Corn	Soybeans	Cotton	Wheat	Grapes	Peaches	Tall fescue	Bermuda-grass	Bahia-grass
	Bu	*Bu*	*Lb of lint*	*Bu*	*Tons*	*Bu*	*A.U.M.*[1]	*A.U.M.*[1]	*A.U.M.*[1]
Bruno loamy fine sand		20	400	30				5.5	5.5
Cane fine sandy loam, 1 to 3 percent slopes	65	30		35	6	210	6.0	6.0	7.0
Cane fine sandy loam, 3 to 8 percent slopes	60	25		30	6	200	6.0	6.0	7.0
Caspiana silt loam	75	40	800	40			8.5	8.5	9.0
Ceda cobbly fine sandy loam									
Enders gravelly fine sandy loam, 5 to 15 percent slopes							4.0	5.0	5.5
Enders-Mountainburg association, rolling									
Enders-Mountainburg association, steep									
Guthrie silt loam							5.5	5.5	6.0
Leadvale silt loam, 1 to 3 percent slopes		30		35	6		7.0	6.5	7.5
Leadvale silt loam, 3 to 8 percent slopes		25		30	6		6.5	6.5	7.0
Leesburg association, rolling							5.5	5.5	6.0
Leesburg association, steep									
Leesburg-Enders association, steep									
Leesburg-Enders association, very steep									
Linker fine sandy loam, 1 to 3 percent slopes		25		30	8	200	6.0	6.0	6.5
Linker fine sandy loam, 3 to 8 percent slopes		20		25	8	180	5.5	5.5	6.0
Linker fine sandy loam, 8 to 12 percent slopes					7	170	5.0	5.0	5.5
Linker association, rolling							5.5	5.0	5.5
Linker-Mountainburg association, rolling.									
Linker soils							5.0	4.5	5.0
Mountainburg soils									
McKamie silt loam, 3 to 8 percent slopes				25			5.0	5.0	5.5
Moreland clay	50	35	650	30			7.0	7.0	7.5
Morganfield silt loam		40	1,000	40			8.0	8.0	8.5
Mountainburg gravelly fine sandy loam, 3 to 12 percent slopes						150	4.0	5.0	5.5
Mountainburg stony fine sandy loam, 1 to 12 percent slopes							3.5	4.5	5.0
Mountainburg stony fine sandy loam, 12 to 65 percent slopes									
Mountainburg-Enders association, rolling									
Mountainburg-Enders association, steep									
Mountainburg-Enders association, very steep									
Mountainburg-Rock outcrop association, very steep									
Muskogee silt loam, 1 to 3 percent slopes	65	25		30			7.0	7.0	7.5
Nella gravelly fine sandy loam, 1 to 3 percent slopes	65			30	6	210	6.5	6.5	7.0
Nella gravelly fine sandy loam, 3 to 8 percent slopes	50			25	6	200	6.0	6.0	6.5
Nella gravelly fine sandy loam, 8 to 12 percent slopes							5.5	5.5	6.0
Nella-Enders association, rolling.									
Nella soils							5.0	5.0	5.5
Enders soils									
Nella-Enders association, steep									
Nella-Enders association, very steep									

See footnote at end of table.

TABLE 2.—*Predicted average yields per acre of principal crops under an improved level of management*—Continued

Soil	Corn	Soybeans	Cotton	Wheat	Grapes	Peaches	Tall fescue	Bermuda-grass	Bahia-grass
	Bu	*Bu*	*Lb of lint*	*Bu*	*Tons*	*Bu*	*A.U.M.*[1]	*A.U.M.*[1]	*A.U.M.*[1]
Nella-Mountainburg association, rolling.									
Nella soils							5.0	5.0	5.5
Mountainburg soils									
Nella-Mountainburg association, steep									
Nella-Mountainburg association, very steep									
Nella soils, rolling							5.0	5.0	5.5
Nella soils, steep									
Pickwick silt loam, 1 to 3 percent slopes	75	30		35	6	220	7.0	7.0	7.5
Pickwick silt loam, 3 to 8 percent slopes	70	25		30	6	210	6.5	6.5	7.0
Roellen clay	50	35	550	30			6.0	6.0	7.0
Spadra fine sandy loam, 1 to 3 percent slopes	75	30		30	6		7.0	7.0	7.5
Taft silt loam		25					7.0	6.0	6.5
Udorthents									

[1] Animal unit months. The figures represent the number of months that 1 acre will provide grazing for 1 animal unit (1,000 pounds live weight), or the number of months the pasture can be grazed multiplied by the number of animal units an acre will support. For example, 1 acre of Cane fine sandy loam in an improved pasture of tall fescue will provide grazing for 2 animals for 3 months, so it has a rating of 6 animal-unit-months.

plants as bermudagrass, tall fescue, bahiagrass, and white clover.

PASTURE AND HAYLAND GROUP 2A

In this group are deep soils that are loamy throughout. They are moderately permeable and are well drained. Some are subject to occasional flooding. These soils have a high potential for growing such forage plants as bermudagrass, tall fescue, bahiagrass, and white clover.

PASTURE AND HAYLAND GROUP 2B

Ceda cobbly fine sandy loam is the only soil in this group. It is a deep, loamy soil that is cobbly throughout. This soil is rapidly permeable, and it is well drained. It is on flood plains and is subject to frequent flooding. Surface cobbles severely limit the use of farm equipment. This soil has a low potential for growing such forage plants as bermudagrass, bahiagrass, and annual lespedeza.

PASTURE AND HAYLAND GROUP 3B

[redacted] group are on uplands and stream terraces. Some are subject to occasional flooding. These soils have a moderately high potential for growing such forage plants as bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza.

PASTURE AND HAYLAND GROUP 8B

In this group are moderately deep to deep, loamy soils. They are moderately permeable and are well drained. These soils are on uplands, and because of slope, they are difficult to manage for forage production with conventional equipment. They have a moderate potential for growing such forage plants as bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza.

PASTURE AND HAYLAND GROUP 8C

In this group are moderately deep to deep soils on uplands and terraces. They have a loamy surface layer and a predominantly clayey subsoil, and some are gravelly. They are very slowly permeable and are well drained. These soils have a moderately low potential [redacted]

PASTURE AND HAYLAND GROUP 8F

In this group are deep, loamy soils that have a fragipan. They are slowly permeable and are somewhat poorly drained to poorly drained. They are on stream terraces in broad valleys. These soils have a moderately high potential for growing such forage plants as [illegible]

three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements.

A rating of *good* means the element of wildlife and kinds of habitats generally are easily created, improved, and maintained. Few or no limitations affect management in this category, and satisfactory [illegible]

cones. They commonly grow in their natural environment, but they may be planted and managed. Typical plants are pines, cedars, and ornamental trees and shrubs.

Wetland plants.—Annual and perennial herbaceous plants that grow wild on wet or moist sites are in this group. They furnish food and cover mostly for wetland wildlife. Typical examples are smartweed, wild millet, spikerush and other rushes, sedges, burreed, cutgrasses, and arrowhead. Submersed and floating aquatics are not included in this category.

Shallow water developments.—These developments are impoundments or excavations for controlling water, generally not more than five feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded;

belong. The next column gives the woodland suitability group. Each group is made up of soils that are suited to the same kind of trees, that need about the same kind of management to produce these trees, and that have about the same potential productivity.

Each woodland suitability group is identified by a three-part symbol. The first part of the symbol, a numeral, indicates the relative productivity of the soils: 1 means very high; 2 means high; 3 means moderately high; 4 means moderate; and 5 means low.

The second part of the sumbol, a letter, indicates the important soil property that imposes a moderate or severe hazard or limitation in managing the soils for wood crops. The letter *x* means that the main limitation is stoniness or rockiness; *w* means that excessive water on or in the soil is the chief limitation; *t* means

TABLE 3.—*Suitability of soils for elements of*

Mapping unit and symbols	Elements of wildlife habitat		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Bruno loamy fine sand: Br	Poor	Poor	Poor
Cane fine sandy loam, 1 to 3 percent slopes: CaB	Good	Good	Good
Cane fine sandy loam, 3 to 8 percent slopes: CaC	Good to fair	Good	Good
Caspiana silt loam: Cp	Good	Good	Good
Ceda cobbly fine sandy loam: Cy	Poor	Fair	Fair
Enders gravelly fine sandy loam, 5 to 15 percent slopes: EnD	Fair	Good	Good
Enders-Mountainburg association, rolling: EMD.			
Enders soils	Poor	Fair	Good
Mountainburg soils	Very poor	Poor	Poor
Enders-Mountainburg association, steep: EME.			
Enders soils	Very poor	Poor	Good
Mountainburg soils	Very poor	Poor	Poor
Guthrie silt loam: Ge	Poor	Fair	Fair
Leadvale silt loam, 1 to 3 percent slopes: LeB	Good	Good	Good
Leadvale silt loam, 3 to 8 percent slopes: LeC	Good to fair	Good	Good
Leesburg association, rolling: LBD	Fair to poor	Good to fair	Good
Leesburg association, steep: LBE	Poor to very poor	Fair to poor	Good
Leesburg-Enders association, steep: LEE.			
Leesburg soils	Poor to very poor	Fair to poor	Good
Enders soils	Very poor	Poor	Good
Leesburg-Enders association, very steep: LEF.			
Leesburg soils	Very poor	Poor	Good

wildlife habitat and for kinds of wildlife

Elements of wildlife habitat—Continued				Kinds of wildlife		
Hardwood woody plants	Coniferous plants	Wetland plants	Shallow water developments	Open-land	Woodland	Wetland
Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor.
Good	Good	Poor	Poor	Good	Good	Poor.
Good	Good	Poor	Very poor	Good	Good	Very poor.
Good		Poor	Very poor	Good	Good	Very poor.
Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor.
Good	Good	Very poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Very poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Good	Good	Very poor	Very poor	Poor	Good	Very poor.
Very poor	Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Fair	Fair	Good	Good	Fair	Fair	Good.
Good	Good	Poor	Poor	Good	Good	Poor.
Good	Good	Poor	Very poor	Good	Good	Very poor.
Good	Good	Very poor	Very poor	Fair to good	Good	Very poor.
Good	Good	Very poor	Very poor	Fair to poor	Good	Very poor.
Good	Good	Very poor	Very poor	Fair to poor	Good	Very poor.

TABLE 3.—*Suitability of soils for elements of*

Mapping unit and symbols	Elements of wildlife habitat		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Nella soils, rolling: NSD	Fair to poor	Good to fair	Good

wildlife habitat and for kinds of wildlife—Continued

Elements of wildlife habitat—Continued				Kinds of wildlife		
Hardwood woody plants	Coniferous plants	Wetland plants	Shallow water developments	Open-land	Woodland	Wetland
Good	Good	Very poor	Very poor	Good to fair	Good	Very poor.
Good	Good	Very poor	Very poor	Fair to poor	Good	Very poor.
Good	Good	Poor	Very poor	Good	Good	Very poor.
Good	Good	Poor	Very poor	Good	Good	Very poor.
Fair		Good	Good	Fair	Fair	Good.
Good	Good	Poor	Very poor	Good	Good	Very poor.
Good	Good	Fair	Fair	Good	Good	Fair.
Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor.

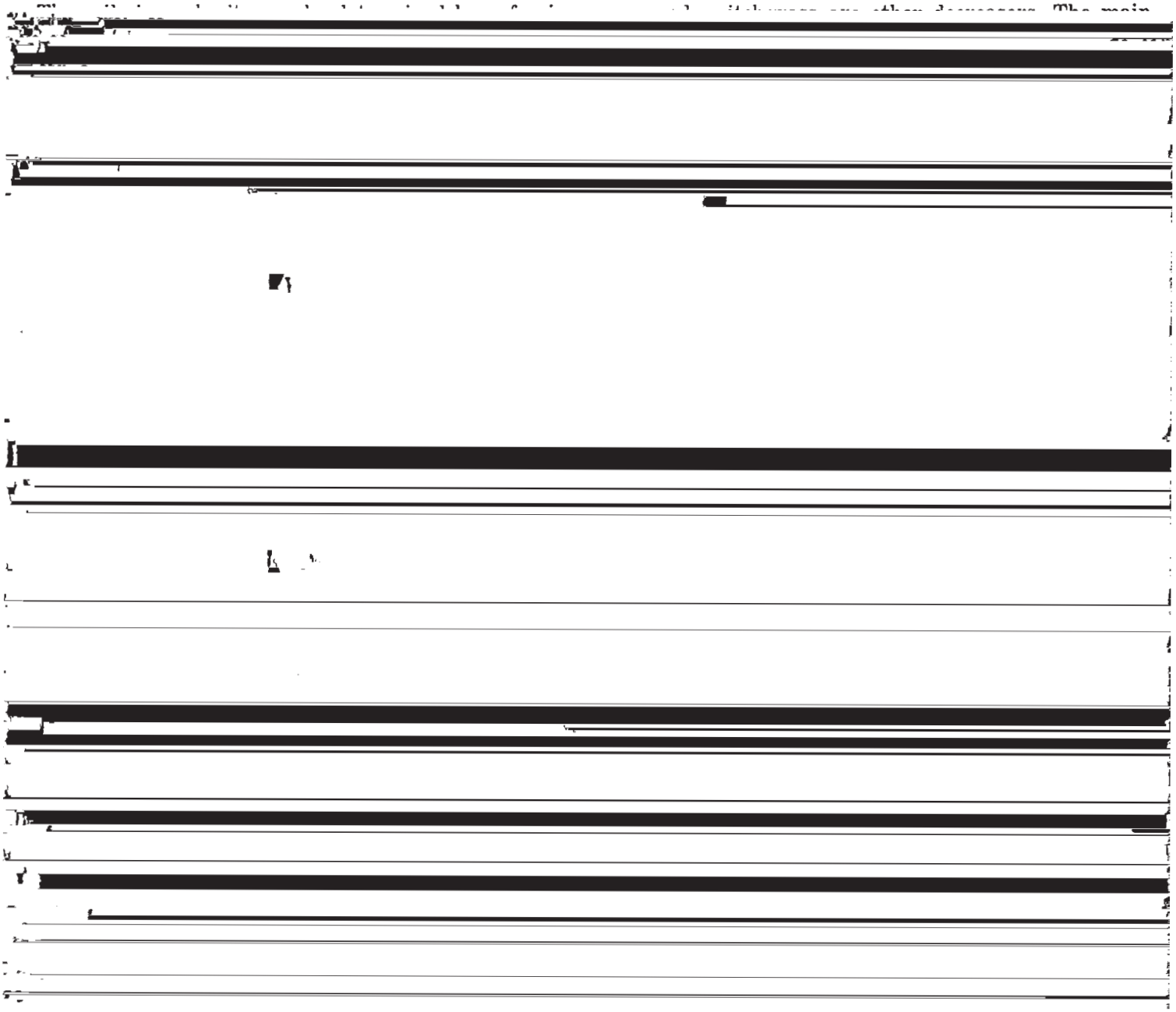


TABLE 4.—*Woodland suitability groups, hazards and limitations,*

[Dashes indicate site index

Soil series and map symbols	Woodland suitability group	Ratings of major hazards and limitations to use and management		
		Erosion	Equipment limitation	Seedling mortality
Bruno: Br	2s5	Slight	Moderate	Moderate
Cane: CaB, CaC	3o7	Slight	Slight	Slight
Caspiana: Cp	2o4	Slight	Slight	Slight
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

potential productivity, and preferred tree species for planting

data are unavailable]

Potential productivity				Preferred species for planting
Important woodland trees	Site index [1]	Understory vegetation (medium canopy) used as forage	Yields	
			Lb per acre	
Cherrybark oak	90	Giant cane, Virginia wildrye, switchgrass, beaked panicum, uniolas, low panicums, honeysuckle, and other plants and shrubs.	3,500 favorable years; 2,000 unfavorable years.	Black walnut, yellow-poplar, black cherry, cherrybark oak, water oak, sweetgum, eastern cottonwood, sycamore.
Water oak	90			
Sweetgum	95			
Eastern cottonwood	105			
Sycamore	90			
Black walnut				
Black cherry				

TABLE 4.—*Woodland suitability groups, hazards and limitations,*

Soil series and map symbols	Woodland suitability group	Ratings of major hazards and limitations to use and management		
		Erosion	Equipment limitation	Seedling mortality
Leadvale: LeB, LeC	3o7	Slight	Slight	Slight
Leesburg: LBD	3o7	Slight	Slight	Slight
LBE, LEE For interpretations of Enders part of LEE, see Enders series.	3r8	Moderate	Moderate	Slight
LEF For interpretations of Enders part of LEF, see Enders series.	3r9	Severe	Severe	Moderate
Linker: LnB, LnC, LnD, LKD, LMD For interpretations of Mountainburg part of LMD, see Mountainburg series.	4o1	Slight	Slight	Slight
McKamie: McC	3c2	Slight	Moderate	Slight to moderate
Moreland: Md	2w6	Slight	Severe	Moderate
Morganfield: Mg	2o4	Slight	Slight	Slight

See footnotes at end of table.

potential productivity, and preferred tree species for planting—Continued

Potential productivity				Preferred species for planting
Important woodland trees	Site index [1]	Understory vegetation (medium canopy) used as forage	Yields	
			Lb per acre	
Loblolly pine	80	Bluestems, plumegrass, switchgrass, indian-grass, wildryes, low	2,500 favorable years; 1,000 unfavorable years.	Loblolly pine, shortleaf pine, eastern redcedar, southern red oak, black
Shortleaf pine	70			
Red oaks	70			
White oaks	60			

TABLE 4.—*Woodland suitability groups, hazards and limitations,*

Soil series and map symbols	Woodland suitability group	Ratings of major hazards and limitations to use and management		
		Erosion	Equipment limitation	Seedling mortality
Mountainburg: MoD (NMD)	5d2	Slight	Slight	Moderate
MsD, MsF, MED, MEE, MEF, MRF, (EMD,				

potential productivity, and preferred tree species for planting—Continued

Potential productivity				Preferred species for planting
Important woodland trees	Site index [1]	Understory vegetation (medium canopy) used as forage	Yields	
Shortleaf pine Eastern redcedar Loblolly pine	50 30 ----	Bluestems, indiangrass, Canada wildrye, switchgrass, low panicums, sedges, and native lespedezas.	2,000 favorable years; 800 unfavorable years.	Loblolly pine, shortleaf pine, eastern redcedar.
Shortleaf pine Eastern redcedar Loblolly pine	50 30 ----	Bluestems, indiangrass, Canada wildrye, switchgrass, low panicums, sedges, and native	2,000 favorable years; 800 unfavorable years.	Loblolly pine, shortleaf pine, eastern redcedar.

TABLE 4.—*Woodland suitability groups, hazards and limitations,*

Soil series and map symbols	Woodland suitability group	Ratings of major hazards and limitations to use and management		
		Erosion	Equipment limitation	Seedling mortality
Spadra: SpB	2o7	Slight	Slight	Slight
Taft: Ta	3w8	Slight	Moderate	Slight
Udorthents: Ud	5r9	Severe	Moderate to severe	Moderate to severe

[1] Site class rating adapted from data gathered in soil site studies by the Soil Conservation Service and the Forest Service.

Engineering Uses of the Soils [7]

This section is useful to those who need information about soils used as structural material or as founda-

5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same

potential productivity, and preferred tree species for planting—Continued

Potential productivity				Preferred species for planting
Important woodland trees	Site index [1]	Understory vegetation (medium canopy) used as forage	Yields	
Shortleaf pine Southern red oak Eastern redcedar	80 80 60	Big bluestem, little bluestem, switchcane, switchgrass, beaked panicum, eastern gamagrass, low panicums, Virginia wildrye, sedges, wild grape, other forbs and shrubs.	3,500 favorable years; 1,500 unfavorable years.	Loblolly pine, shortleaf pine, black walnut, black cherry, black locust, southern red oak, eastern redcedar, cherrybark oak.
Water oak Sweetgum Loblolly pine Shortleaf pine	70 70 70 60	Switchgrass, eastern gamagrass, Florida paspalum, plumegrass, longspike tridens, beaked panicum, broadleaf uniola, St. Johnswort, wild grape, and other shrubs.	3,500 favorable years; 1,800 unfavorable years.	Loblolly pine, sweetgum, water oak.
Shortleaf pine Eastern redcedar	55 35	Switchgrass, eastern gamagrass, Florida paspalum, plumegrass, longspike tridens, beaked panicum, broadleaf uniola, St. Johnswort, wild grape, and other shrubs.	3,500 favorable years; 1,800 unfavorable years.	Loblolly pine, shortleaf pine, eastern redcedar, black locust, Virginia pine.

[1] Plant only on north- and east-facing slopes, coves, benches, and bases of slopes.

Some of the terms used in this soil survey have special meaning to soil scientists but are not known to all engineers. Many of the terms commonly used in soil science are defined in the Glossary.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified Soil Classification system (*4*) used by the SCS engineers, Department of Defense, and others, and the AASHTO system (*2*) adopted by the American Association of State Highway (and Transportation) Officials.

In the Unified system soils are classified according to particle size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes: eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction (*1*) and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

USDA texture (*10*) is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

TABLE 5.—*Estimated soil properties*

[Absence of data indicates that the soil is too variable to be rated or that no estimate was made. The symbol > means greater than; the kinds of soils that may have different properties. For this reason the reader should

	Depth to—			Classification	Coarse

significant in engineering

symbol < means less than. An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more follow carefully the instructions for referring to another series in the first column]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability [1]	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Ins per hr	*Ins per in of soil*	*pH*			
--------	100	70–100	20–35	--------	[3] NP	>6.0	0.05–0.11	6.1–7.3	Low------	Low------	Low.
90–100	85–95	80–95	55–70	<30	NP–7	0.6–2.0	0.11–0.15	5.1–6.0	Low------	Low------	Moderate.
90–100	85–95	80–95	65–80	20–30	2–10	0.6–2.0	0.15–0.20	5.1–6.0	Low------	Moderate--	Moderate.
90–100	85–95	80–95	70–85	30–40	12–22	0.2–0.6	0.15–0.20	4.5–5.5	Moderate--	Moderate--	Moderate to high.
90–100	85–95	80–95	55–85	30–40	12–22	0.06–0.2	0.07–0.10	4.5–5.5	Moderate--	High------	Moderate to high.
90–100	85–95	80–95	55–70	30–40	12–22	0.2–0.6	0.12–0.17	4.5–5.5	Moderate--	High------	Moderate to high.
95–100	95–100	90–100	70–90	<30	NP–7	0.6–2.0	0.16–0.24	5.6–6.5	Low------	Low------	Moderate to low.
95–100	95–100	90–100	80–95	30–40	12–22	0.6–2.0	0.18–0.22	5.6–7.3	Moderate--	Moderate--	Moderate to low.
95–100	95–100	85–95	55–70	20–30	2–10	0.6–2.0	0.13–0.20	6.6–7.8	Low------	Low------	Low.
80–90	75–85	55–70	25–45	<20	NP–3	>6.0	0.05–0.08	5.1–6.5	Low------	Low------	Moderate.
75–85	70–80	50–65	20–40	<20	NP–3	>6.0	0.04–0.07	5.1–6.5	Low------	Low------	Moderate.
70–80	65–80	60–75	55–70	20–30	4–10	0.6–2.0	0.07–0.15	4.5–5.5	Low------	Low------	Moderate to high.
90–100	85–100	85–95	70–85	30–40	12–22	0.2–0.6	0.12–0.20	4.5–5.5	Moderate--	Moderate--	Moderate to high.
90–100	90–100	85–95	75–90	65–80	35–45	<0.06	0.12–0.18	4.5–5.5	Moderate to high.	High------	Moderate to high.
100	95–100	95–100	85–95	23–30	4–10	0.6–2.0	0.16–0.24	5.1–6.5	Low------	High------	Moderate to low.
100	95–100	95–100	85–95	27–37	10–18	0.6–2.0	0.16–0.24	4.5–5.5	Low------	High------	Moderate to high.
100	95–100	95–100	85–95	30–40	12–20	0.06–0.2	0.09–0.11	4.5–5.5	Low------	High------	Moderate to high.
100	95–100	95–100	85–95	30–40	12–20	0.06–0.2	0.09–0.11	5.1–6.5	Low------	High------	Moderate to low.
95–100	95–100	90–100	65–95	<25	NP–4	0.6–2.0	0.16–0.24	5.1–6.5	Low------	Moderate--	Moderate to low.
95–100	95–100	90–100	65–95	<30	NP–7	0.6–2.0	0.16–0.24	4.5–6.0	Low------	High------	Moderate to high.
95–100	95–100	90–100	85–95	30–40	11–20	0.6–2.0	0.16–0.24	4.5–5.5	Low------	High------	Moderate to high.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
	Bedrock	Seasonal high water table			Unified	AASHTO	
	In	*Ft*	*In*				
McKamie: McC	>72	>6	0–3	Silt loam	ML or CL–ML	A–4	
			3–7	Silty clay loam	CL	A–6	
			7–55	Clay	CH	A–7	
			55–72	Clay loam	CL	A–6 or A–7	
Moreland [2]: Md	>72	2–2½	0–37	Clay	CH	A–7	
			37–72	Silty clay loam and clay loam.	CL	A–6 or A–7	
Morganfield [2]: Mg	>72	>6	0–72	Silt loam and very fine sandy loam.	ML or CL–ML	A–4	
*Mountainburg: MoD, MsD, MsF, MED, MEE, MEF, MRF. For properties of Enders parts of MED, MEE, and MEF, see Enders series. Rock outcrop part of MRF was not rated.	12–20	>6	0–3	Gravelly fine sandy loam.	GM	A–1 or A–2	5–15
			3–13	Gravelly sandy clay loam and gravelly fine sandy loam.	GM, GC, GC–GM, or GM–GP	A–1 or A–2	15–30
Muskogee: MzB	>60	>6	0–9	Silt loam	ML, CL, CL–ML	A–4	
			9–23	Silty clay loam	CL	A–6 or A–7	
			23–72	Clay	CH or MH	A–7	
*Nella: NaB, NaC, NaD, NED, NEE, NEF, NMD, NME, NMF, NSD, NSE. For properties of Enders part of NED, NEE, and NEF, see Enders series. For properties of Mountainburg parts of NMD, NME, and NMF, see Mountainburg series.	>72	>6	0–7	Gravelly fine sandy loam.	GM, GC–GM, SM, or SC–SM	A–2 or A–4	0–20
			7–36	Gravelly sandy clay loam and gravelly clay loam.	CL or SC	A–2, A–4, or A–6	0–15
			36–54	Gravelly clay loam.	GC, SC, or CL	A–2, A–4, or A–6	0–15
			54–72	Clay loam	GC, SC, or CL	A–4 or A–6	0–50
Pickwick: PcB, PcC	>72	>6	0–12	Silt loam and loam.	ML or CL–ML	A–4	
			12–72	Silty clay loam	CL	A–6	
Rock outcrop. Bedrock at or near the surface. Mapped only in association with Mountainburg soils.							
Roellen [2]: Ro	>72	1–2	0–37	Clay	CH	A–7	
			37–72	Clay	CH	A–7	
Spadra [2]: SpB	>72	>6	0–8	Fine sandy loam	ML, CL–ML, SM, or SC–SM	A–2 or A–4	
			8–39	Sandy clay loam	CL	A–4 or A–6	
			39–55	Fine sandy loam	ML, CL–ML, SM, or SC–SM	A–4	
			55–72	Fine sandy loam	ML, CL–ML, SM, or SC–SM	A–2 or A–4	
Taft: Ta	>60	0–1	0–8	Silt loam	ML or CL–ML	A–4	
			8–20	Silt loam	CL	A–4 or A–6	
			20–40	Silty clay loam	CL	A–6	
			40–72	Silty clay	CL, CH, or MH	A–6 or A–7	
Udorthents: Ud. Too variable to be estimated.							

[1] These values should not be confused with the coefficient "K" used by engineers.
[2] All or parts of these soils are subject to flooding.

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability [1]	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
						Ins per hr	*Ins per in of soil*	*pH*			
--------	100	95–100	85–95	<30	NP–7	0.6–2.0	0.16–0.24	5.1–6.0	Low------	Low------	Moderate.
--------	100	95–100	85–95	30–40	12–20	0.2–0.6	0.18–0.22	5.1–6.0	Moderate..	Moderate..	Moderate.
--------	100	95–100	85–95	51–70	25–40	<0.06	0.12–0.18	4.5–5.5	High------	High------	Moderate to high.
--------	100	95–100	85–95	30–50	12–25	0.2–0.6	0.15–0.20	4.5–7.8	Moderate..	High------	Low to high.
--------	100	95–100	90–100	51–75	25–45	<0.06	0.12–0.18	6.1–7.8	High------	High------	Low.
--------	100	95–100	90–100	30–50	12–25	<0.06	0.15–0.22	6.1–7.8	Moderate..	High------	Low.
--------	100	95–100	65–95	<30	NP–5	0.6–2.0	0.13–0.24	6.1–8.4	Low------	Low------	Low.
35–50	30–50	25–40	20–35	--------	NP	2.0–6.0	0.05–0.10	5.1–6.0	Low------	Low------	Moderate.
30–50	25–50	20–40	10–25	<30	NP–10	2.0–6.0	0.05–0.10	4.5–5.5	Low------	Low------	Moderate to high.
100	95–100	90–100	85–95	20–32	1–10	0.6–2.0	0.16–0.24	4.5–5.5	Low------	Low------	Moderate to high.
100	95–100	90–100	85–95	30–45	12–22	0.2–0.6	0.18–0.22	4.5–5.5	Moderate..	Moderate..	Moderate to high.
100	95–100	90–100	85–95	51–70	22–40	0.06–0.2	0.12–0.18	4.5–5.5	High------	High------	Moderate to high.
55–85	50–75	40–65	15–45	<25	NP–5	0.6–2.0	0.08–0.13	5.1–6.0	Low------	Low------	Moderate.
65–90	60–85	50–75	25–55	27–40	8–20	0.6–2.0	0.10–0.15	4.5–6.0	Low------	Low------	Moderate to high.
40–90	35–85	40–75	15–55	30–40	10–20	0.6–2.0	0.10–0.15	4.5–6.0	Low------	Low------	Moderate to high.
65–90	55–85	50–70	40–60	30–40	10–20	0.6–2.0	0.08–0.15	4.5–6.0	Low------	Low------	Moderate to high.
95–100	95–100	90–100	65–90	<30	NP–7	0.6–2.0	0.15–0.24	5.1–6.5	Low------	Low------	Moderate.
100	95–100	95–100	75–95	30–40	14–22	0.6–2.0	0.18–0.22	4.5–5.5	Moderate..	Moderate..	Moderate to high.
--------	100	95–100	90–100	51–80	28–50	0.06–0.2	0.12–0.18	5.6–7.3	High------	High------	Low.
--------	100	95–100	90–100	51–80	28–50	0.06–0.2	0.12–0.18	5.6–7.8	High------	High------	Low.
85–100	80–100	65–80	30–75	<30	NP–5	0.6–2.0	0.09–0.15	5.1–6.0	Low------	Low------	Moderate.
90–100	85–100	80–95	55–75	28–40	8–15	0.6–2.0	0.10–0.17	4.5–5.5	Low------	Low to moderate.	Moderate to high.
90–100	85–100	70–85	36–80	<30	NP–7	0.6–2.0	0.09–0.15	4.5–5.5	Low------	Low------	Moderate to high.
70–100	55–100	40–80	20–65	<30	NP–5	0.6–2.0	0.08–0.15	4.5–5.5	Low------	Low------	Moderate to high.
100	95–100	90–100	85–95	<30	NP–	0.6–2.0	0.16–0.24	4.5–6.0	Low------	High------	Moderate to high.
100	95–100	90–100	85–95	25–35	8–15	0.6–2.0	0.16–0.24	4.5–5.5	Low------	High------	Moderate to high.
100	95–100	90–100	85–95	30–40	11–20	0.06–0.2	0.07–0.10	4.5–5.5	Low------	High------	Moderate to high.
100	95–100	90–100	85–95	35–60	15–30	0.06–0.2	0.14–0.18	4.5–5.5	Moderate..	High------	Moderate to high.

[3] Nonplastic.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one of the mapping units in this series is made up of two or more kinds of soils that to another series given

Soil series and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil	Roadfill [1]	Pond reservoir areas
Bruno: Br	Poor: sandy material	Good to fair: high to moderate bearing capacity.	High seepage rate
Cane: CaB, CaC	Fair: thin layer over moderately plastic material; material below a depth of 20 inches is difficult to reclaim.	Fair: moderate bearing capacity.	Soil features generally favorable
[illegible]	[illegible]	[illegible]	Moderate permeability

properties of the soils

may have different properties and different interpretations. For this reason the reader should follow carefully the instructions for referring in the first column]

Soil features affecting—Continued			
Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Medium strength; low to medium compressibility; medium to low permeability; fair compaction characteristics; subject to piping.	Excessively drained	Rapid intake rate; rapid permeability; low available water capacity.	Level to nearly level soil on bottom lands; practice not applicable.
Fair to good strength and compaction characteristics; medium to high compressibility.	Moderately well drained; slopes	Slow intake rate; slow permeability; medium available water capacity; medium runoff.	Soil features generally favorable.
Medium to low strength; medium compressibility; medium to low permeability; fair to good compaction characteristics; subject to piping unless well mixed.	Well drained	Moderate intake rate; high available water capacity.	Level to nearly level soil; practice not applicable.
Medium strength; low to medium compressibility; medium to low permeability; fair compaction characteristics; subject to piping.	Well drained	Rapid intake rate; low available water capacity.	Level to nearly level; frequently flooded soil on bottom lands; practice not applicable.
Low strength; high compressibility; low to medium permeability; fair to poor compaction characteristics.	Well drained; slopes	Slow intake rate; very slow permeability; high available water capacity; rapid runoff, generally nonarable soil.	Generally nonarable soil; impractical where slopes are more than 8 percent; erodible; very slow permeability; difficult to vegetate terrace channel; subsoil material in terrace embankment likely to crack when dry; terraces may fail.
Medium to low strength; medium compressibility; fair compaction characteristics; subject to piping.	Slow permeability; poorly drained.	Slow intake rate; slow permeability; poorly drained; medium available water capacity.	Level soil; practice not applicable.
Medium to low strength; medium compressibility; fair compaction characteristics; subject to piping unless well mixed.	Moderately well drained; slopes	Moderate intake rate; moderately slow permeability; medium available water capacity.	Soil features generally favorable.
Medium to low strength; low to medium compressibility; low permeability; fair to good compaction characteristics.	Well drained; slopes	Moderate intake rate; moderate permeability; medium available water capacity; rapid to very rapid runoff; generally nonarable soil.	Slopes excessive.
Medium strength; medium compressibility; fair compaction characteristics; thin layer of borrow material.	Well drained; slopes	Moderate intake rate; moderate permeability; medium available water capacity; medium to rapid runoff.	Soil features generally favorable; impractical where slopes are more than 8 percent; erodible; subject to piping; bedrock at a depth between 20 and 40 inches.
Medium strength; medium compressibility; fair compaction characteristics; thin layer of borrow material.	Well drained; slopes	Moderate intake rate; moderate permeability; medium available water capacity; rapid runoff.	Slopes excessive.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil	Roadfill [1]	Pond reservoir areas
McKamie: McC	Poor: thin layer over plastic, clayey material.	Poor: low bearing capacity; high shrink-swell potential.	Soil features generally favorable.
Moreland: Md	Poor: plastic, clayey material.	Poor: low bearing capacity; high shrink-swell potential.	Soil features generally favorable.
Morganfield: Mg	Good	Fair: moderate bearing capacity.	Moderate permeability
*Mountainburg: MoD, MsD, MsF, MED, MEE, MEF, MRF. For interpretations of Enders parts of MED, MEE, and MEF, see Enders series. For interpretations of Rock outcrop part of MRF, see Rock outcrop.	Poor: coarse fragments; thin layer; bedrock at a depth between 12 and 20 inches; many slopes exceed 15 percent; excavated area difficult or impossible to reclaim.	Poor: thin layer; coarse fragments; many slopes exceed 25 percent; excavated area impossible to reclaim.	High seepage rate; bedrock at a depth between 12 and 16 inches.
Muskogee: MzB	Fair: thin layer over moderately plastic material.	Poor: low bearing capacity; high shrink-swell potential.	Soil features generally favorable.
*Nella: NaB, NaC, NaD	Poor: coarse fragments	Fair to good: moderate to high bearing capacity.	Moderate permeability
NED, NEE, NEF, NMD, NME, NMF, NSD, NSE. For interpretations of Enders parts of NED, NEE, and NEF, see Enders series. For interpretations of Mountainburg parts of NMD, NME, and NMF, see Mountainburg series.	Poor: coarse fragments; most slopes exceed 15 percent.	Fair where slopes are less than 25 percent. Poor where slopes exceed 25 percent.	Moderate permeability
Pickwick: PcB, PcC	Fair: thin layer over moderately plastic material.	Fair to poor: moderate bearing capacity.	Moderate permeability
Rock outcrop. Mapped only in association with Mountainburg soils.	Unsuited: bedrock at or near the surface.	Unsuited: bedrock at or near the surface.	Bedrock at or near the surface.
Roellen: Ro	Poor: plastic, clayey material.	Poor: low bearing capacity; high shrink-swell potential.	Soil features generally favorable.
Spadra: SpB	Fair: thin layer over moderately plastic material.	Fair: moderate bearing capacity.	Moderate permeability

See footnote at end of table.

properties of the soils—Continued

Soil features affecting—Continued			
Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Terraces and diversions
Medium to low strength; high compressibility; low permea-	Well drained; slopes	Slow intake rate; very slow permeability; high avail-	Erodible; very slow permeability; difficult to vegetate

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as a source of—		Soil features affecting—
	Topsoil	Roadfill [1]	Pond reservoir areas
Taft: Ta	Good	Fair: moderate bearing capacity; poor below a depth of 40 inches; low bearing capacity.	Soil features generally favorable.
Udorthents: Ud	Poor: coarse fragments; most slopes exceed 15 percent.	Poor: coarse fragments; many slopes exceed 25 percent.	Variable material; moderately slow to moderately rapid permeability.

[1] Engineers and others should not apply specific values to estimates given for bearing capacity of soils.

TABLE 7.—*Engineering*

[Tests performed by the Arkansas State Highway Department, Division of Materials

Soil name and location	Parent material	Arkansas SCS report number S71-Ark-60-	Moisture density [1]		
			Depth	Maximum dry density	Optimum moisture
			In	*Lb per ft³*	*Pct*
Caspiana silt loam: SW¼NW¼NW¼ sec. 32, T. 9 N., R. 25 W. (Modal).	Loamy alluvium.	2-2	10-24	107	17
		2-4	30-40	111	16
		2-5	40-52	106	15
Leadvale silt loam: NW¼NE¼SW¼ sec. 20, T. 9 N., R. 25 W. (Modal).	Loamy valley fill.	15-2	5-10	111	13
		15-4	18-23	113	16
		15-5	23-49	104	20
Morganfield silt loam: NW¼NE¼SW¼ sec. 32, T. 9 N., R. 25 W. (Modal).	Loamy alluvium.	16-2	7-14	106	16
		16-3	14-30	101	18
		16-4	30-41	103	17
Muskogee silt loam: SE¼NE¼NE¼ sec. 20, T. 9 N., R. 24 W. (Modal).	Loamy and clayey alluvium.	13-2	4-9	108	17
		13-4	23-39	95	26
		13-5	39-50	96	21
Pickwick silt loam: SE¼SE¼SW¼ sec. 6, T. 9 N., R. 23 W. (Modal).	Loamy alluvium.	6-1	0-6	113	12
		6-3	12-22	115	15
		6-5	35-52	111	17

[1] Based on AASHTO designation T-99-57, Method A (*2*).

[2] Mechanical analyses according to the AASHTO designation T-88-57 (*2*). Results of this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by hydrometer method, and the various grain-sized fractions are calculated on the basis of all material up to and including that 3 inches in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculation of grain-sized fractions. The mechanical analyses data used in this table are not suitable for use in naming textural classes of soil.

properties of the soils—Continued

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years. The depths given in table 5 are the depths to a seasonal perched water table that is separated from the permanent water table by an impervious layer or a dry zone.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand,

structures built in, on, or with material having this rating.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among unfavorable factors.

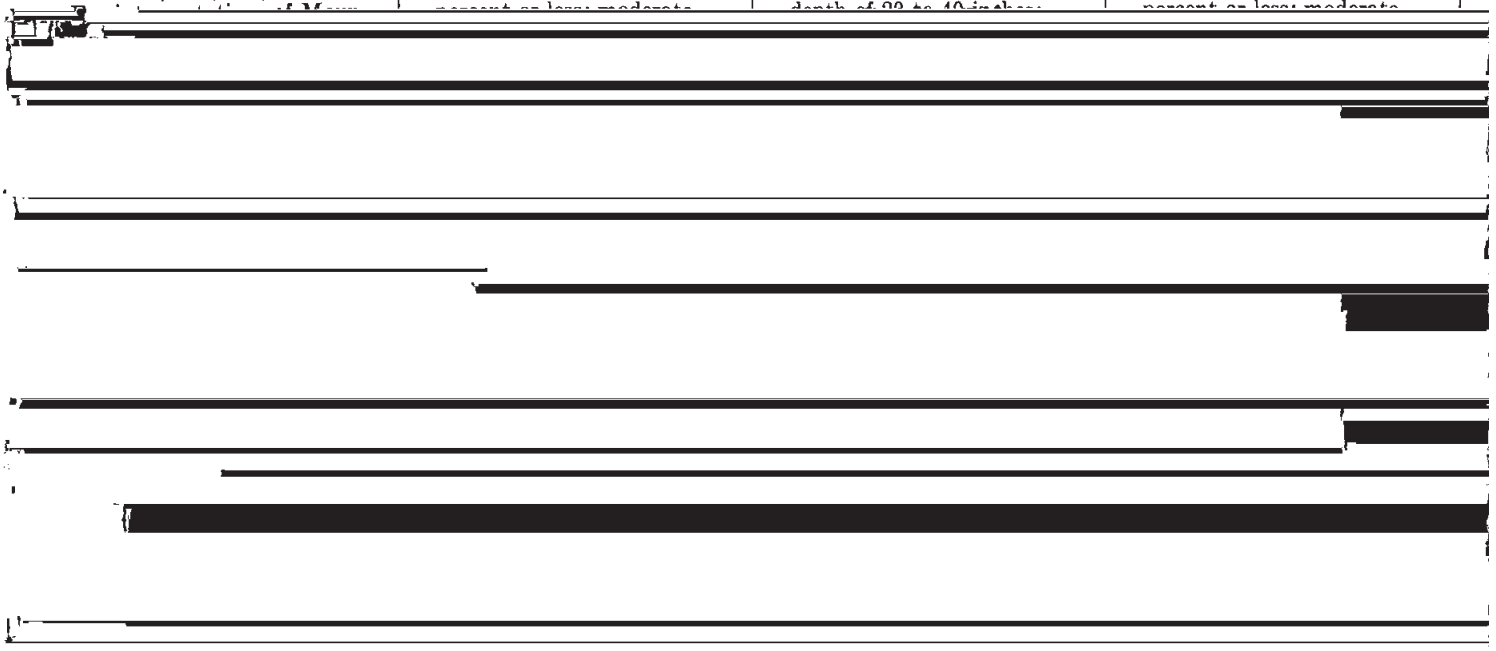
Town and Country Planning

Table 8 gives the degree and kind of limitation of the soils of Johnson County for selected nonfarm uses. The degrees of limitation reflect all the features of the given soil, to a depth of about 6 feet or to bedrock, that affect a particular use (fig. 10).

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties are generally favorable for the rated use—limita-

TABLE 8.—*Degree and kind of limitation for building*

Soil series and map symbols	Dwellings without basements [1]	Shallow excavations	Local roads and streets [1]
Bruno: Br	Slight in areas not subject to flooding. Severe in areas subject to occasional flooding.	Severe: predominantly sandy material; sidewalls unstable.	Slight in areas not subject to flooding. Moderate in areas subject to occasional flooding.
Cane: CaB, CaC	Moderate: moderate bearing capacity.	Moderate: moderately well drained; perched seasonal high water table.	Moderate: moderate bearing capacity.
Caspiana: Cp	Moderate in areas not subject to flooding; moderate bearing capacity. Severe in areas subject to occasional flooding.	Slight in areas not subject to flooding. Moderate in areas subject to occasional flooding.	Moderate: moderate bearing capacity; some areas are subject to occasional flooding.
Ceda: Cy	Severe: subject to frequent flooding.	Severe: coarse fragments; subject to frequent flooding.	Severe: subject to frequent flooding.
Enders: EnD, EMD, EME For interpretation of Mountainburg parts of EMD and EME, see Mountainburg series.	Severe: low bearing capacity; moderate to high shrink-swell potential; many slopes exceed 15 percent.	Severe: predominantly clayey material; many slopes exceed 15 percent.	Severe: low bearing capacity; moderate to high shrink-swell potential; many slopes exceed 15 percent.
Guthrie: Ge	Severe: poorly drained; perched seasonal high water table; low bearing capacity.	Severe: poorly drained; perched seasonal high water table.	Severe: poorly drained; low bearing capacity.
Leadvale: LeB, LeC	Moderate: moderately well drained; moderate bearing capacity.	Moderate: moderately well drained; perched seasonal high water table.	Moderate: moderate bearing capacity.
Leesburg: LBD, LBE, LEE, LEF For interpretations of Enders part of LEE and LEF, see Enders series.	Moderate where slopes are 8 to 15 percent; moderate bearing capacity. Severe where slopes exceed 15 percent.	Moderate where slopes are 8 to 15 percent; coarse fragments. Severe where slopes exceed 15 percent.	Moderate where slopes are 8 to 15 percent; moderate bearing capacity. Severe where slopes exceed 15 percent.
Linker: LnB, LnC, LnD, LKD, LMD	Moderate where slopes are 15	Severe: hard bedrock is at a	Moderate where slopes are 15



sites and sewage and solid-waste disposal systems

Light industry [1]	Septic-tank absorption fields	Sewage lagoons [2]	Sanitary landfill (trench type) [3]
Slight in areas not subject to flooding. Severe in areas subject to occasional flooding.	Slight in areas not subject to flooding or pollution of ground water. Severe in areas subject to occasional flooding or that have a hazard of pollution of ground water.	Severe: rapid permeability; some areas subject to occasional flooding.	Severe: rapid permeability.
Moderate: moderate bearing capacity.	Severe: slow permeability	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 7 percent. Severe where slopes exceed 7 percent.	Moderate: moderately well drained; material somewhat plastic.
Moderate in areas not subject to flooding; moderate bearing capacity. Severe in areas subject to occasional flooding.	Moderate in areas not subject to flooding; moderate permeability. Severe in areas subject to occasional flooding.	Moderate in areas not subject to flooding; moderate permeability. Severe in areas subject to occasional flooding.	Moderate in areas not subject to flooding; material somewhat plastic. Severe in areas subject to occasional flooding.
Severe: subject to frequent flooding.	Severe: subject to frequent flooding.	Severe: coarse fragments; subject to frequent flooding.	Severe: coarse fragments; subject to frequent flooding.
Severe: low bearing capacity; moderate to high shrink-swell potential; most slopes exceed 8 percent.	Severe: very slow permeability; many slopes exceed 15 percent.	Moderate where slopes are 7 percent or less. Severe where slopes exceed 7 percent.	Severe: predominantly clayey material; many slopes exceed 25 percent.
Severe: poorly drained; perched seasonal high water table; low bearing capacity.	Severe: slow permeability; perched seasonal high water table.	Slight	Severe: poorly drained; perched seasonal high water table.
Moderate: moderately well drained; moderate bearing capacity; many slopes exceed 4 percent.	Severe: moderately slow permeability; perched seasonal high water table.	Slight where slopes are 2 percent or less. Moderate where slopes are 2 to 7 percent. Severe where slopes exceed 7 percent.	Moderate: moderately well drained; material somewhat plastic.
Severe: slopes exceed 8 percent	Moderate where slopes are 8 to 15 percent. Severe where slopes exceed 15 percent.	Severe: slopes exceed 7 percent.	Moderate where slopes are 8 to 25 percent; coarse fragments. Severe where slopes exceed 25 percent.
Moderate where slopes are 8 percent or less; moderate bearing capacity; hard bedrock is at a depth of 20 to 40 inches. Severe where slopes exceed 8 percent.	Severe: hard bedrock is at a depth of 20 to 40 inches; many slopes in LMD exceed 15 percent.	Severe: hard bedrock is at a depth of 20 to 40 inches; many slopes exceed 7 percent.	Severe: hard bedrock is at a depth of 20 to 40 inches.
Severe: low bearing capacity; high shrink-swell potential.	Severe: very slow permeability.	Moderate where slopes are 3 to 7 percent. Severe where slopes exceed 7 percent.	Severe: plastic, clayey material.
Severe: low bearing capacity; high shrink-swell potential; perched seasonal high water table; some areas subject to occasional flooding.	Severe: very slow permeability; perched seasonal high water table.	Slight in areas not subject to flooding. Severe in areas subject to occasional flooding.	Severe: perched seasonal high water table; predominantly plastic, clayey material.
Moderate in areas not subject to flooding; moderate bearing capacity. Severe in areas subject to occasional flooding.	Slight in areas not subject to flooding. Severe in areas subject to occasional flooding.	Moderate in areas not subject to flooding; moderate permeability. Severe in areas subject to occasional flooding.	Slight in areas not subject to flooding. Moderate in areas subject to occasional flooding.
Severe: hard bedrock is at a depth of 12 to 20 inches; many slopes exceed 8 percent.	Severe: hard bedrock is at a depth of 12 to 20 inches; many slopes exceed 15 percent.	Severe: hard bedrock is at a depth of 12 to 20 inches; coarse fragments; many slopes exceed 7 percent.	Severe: hard bedrock is at a depth of 12 to 20 inches; coarse fragments; some slopes exceed 25 percent.

TABLE 8.—*Degree and kind of limitation for building*

Soil series and map symbols	Dwellings without basements [1]	Shallow excavations	Local roads and streets [1]
Muskogee: MzB	Severe: low strength; moderate to high shrink-swell potential.	Severe: predominantly plastic, clayey material.	Severe: low bearing capacity; moderate to high shrink-swell potential.
Nella: NaB, NaC, NaD, NED,	Slight to moderate where slopes	Moderate where slopes are 1 to	Slight to moderate where slopes

sites and sewage and solid-waste disposal systems—Continued

Light industry [1]	Septic-tank absorption fields	Sewage lagoons [2]	Sanitary landfill (trench type) [3]
Severe: low strength; moderate to high shrink-swell potential.	Severe: slow permeability	Slight where slopes are 1 to 2 percent. Moderate where slopes exceed 2 percent.	Severe: predominantly plastic, clayey material.
Slight to moderate where slopes are 1 to 4 percent; moderate to high bearing capacity. Moderate where slopes are 4 to 8 percent. Severe where slopes exceed 8 percent.	Slight where slopes are 1 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes exceed 15 percent.	Moderate where slopes are 1 to 7 percent; moderate permeability. Severe where slopes exceed 7 percent.	Moderate where slopes are 1 to 25 percent; coarse fragments. Severe where slopes exceed 25 percent.
Moderate: moderate bearing capacity.	Slight	Moderate where slopes are 1 to 7 percent; moderate permeability. Severe where slopes exceed 7 percent.	Moderate: material somewhat plastic.

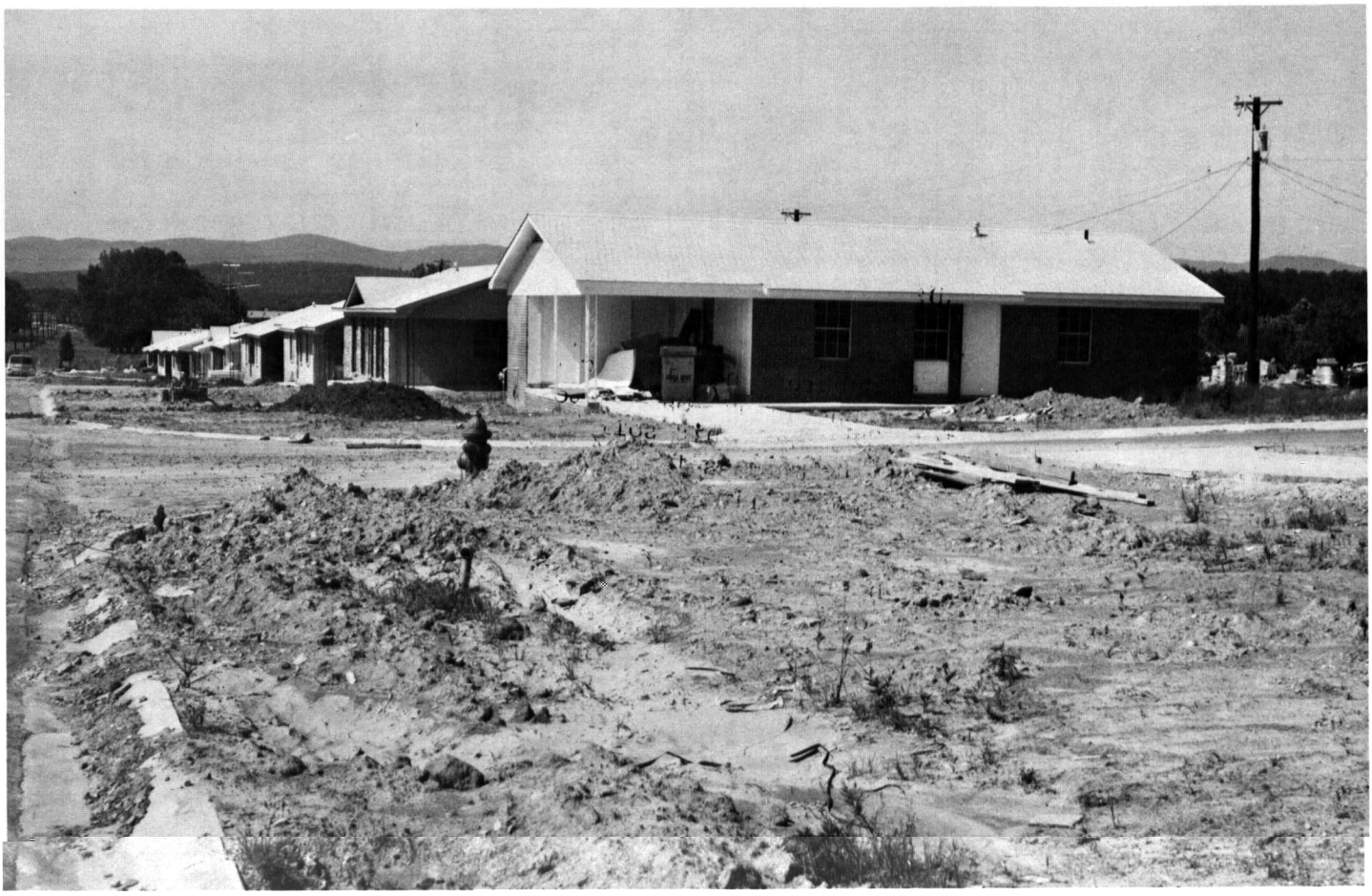
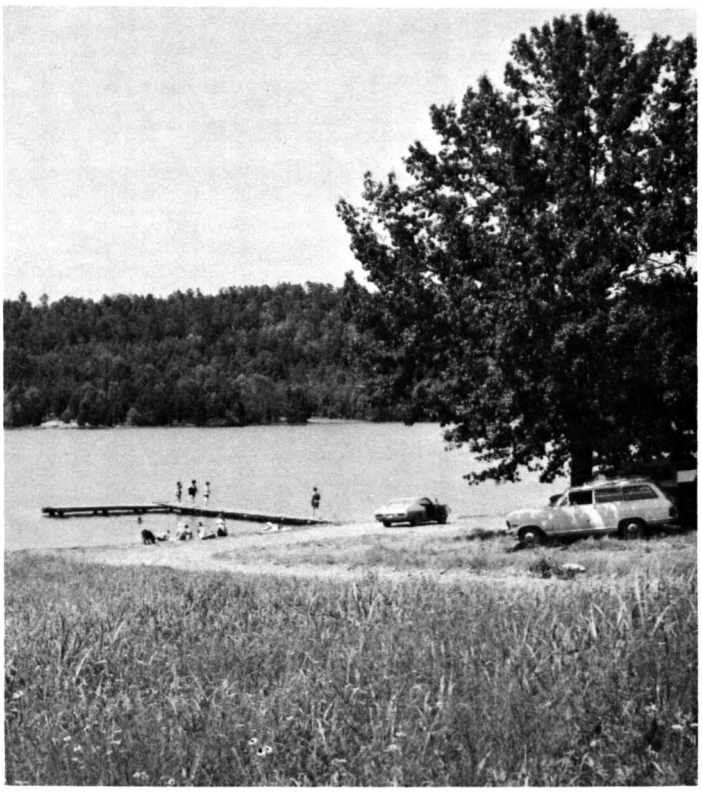


Figure 10.—**The Linker fine sandy loam shown has severe limitations for most nonfarm uses but only moderate limitations for homesites.**

In table 9 the soils are rated as having slight, mod- foot traffic. The best soils have a nearly level surface



parent material, and relief interact over a period of

The interaction of the five factors of soil formation is more complex for some soils than for others. The five factors and how they interact to form some of the soils in the county are discussed in the following paragraphs.

TABLE 9.—*Degree and kind of limitation for recreational development*

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails
Bruno: Br	Moderate where areas	Moderate where areas	Moderate where areas	Severe: sandy surface;

TABLE 9.—*Degree and kind of limitation for recreational development*—Continued

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails
Morganfield: Mg	Slight where areas are not subject to flooding. Moderate where areas are subject to occasional flooding.	Slight where areas are not subject to flooding. Moderate where areas are subject to occasional flooding.	Slight where areas are not subject to flooding. Moderate where areas are subject to occasional flooding.	Slight.
Mountainburg: MoD	Moderate: coarse fragments; many slopes exceed 8 percent; difficult to maintain vegetative cover.	Severe: coarse fragments; hard bedrock is at a depth of 12 to 20 inches; most slopes exceed 6 percent; difficult to maintain vegetative cover.	Moderate: coarse fragments; many slopes exceed 8 percent; difficult to maintain vegetative cover.	Moderate: coarse fragments.
MsD, MsF, MED, MEE, MEF, MRF (LMD, NMD, NME, NMF). For interpretations of Enders part of MED, MEE, and MEF, see Enders series. For interpretations of Rock outcrop part of MRF, see Rock outcrop.	Severe: surface stones; many slopes exceed 15 percent; difficult to maintain vegetative cover.	Severe: surface stones; hard bedrock is at a depth of 12 to 20 inches; most slopes exceed 6 percent; difficult to maintain vegetative cover.	Moderate where slopes are 15 percent or less: surface stones; difficult to maintain vegetative cover. Severe where slopes exceed 15 percent.	Severe: surface stones; many slopes exceed 25 percent.
Muskogee: MzB	Moderate: slow permeability.	Moderate: slow permeability; some slopes exceed 2 percent.	Slight	Slight.
Nella: NaB, NaC, NaD	Moderate: coarse fragments; slope.	Moderate where slopes are 6 percent or less; coarse fragments. Severe where slopes exceed 6 percent.	Moderate: coarse fragments; slope.	Moderate: coarse fragments.
NED, NEE, NEF, NMD, NME, NMF, NSD, NSE. For interpretations of Enders parts of NED, NEE, and NEF, see Enders series. For interpretations of Mountainburg parts of NMD, NME, and NMF, see Mountainburg series.	Moderate where slopes are 15 percent or less; coarse fragments; slope; surface stones in some areas. Severe where slopes exceed 15 percent.	Moderate where slopes are 15 percent or less: coarse fragments; surface stones in some areas. Severe where slopes exceed 15 percent.	Moderate where slopes are 15 percent or less: coarse fragments; slope. Severe where slopes exceed 15 percent.	Moderate where slopes are 25 percent or less: coarse fragments; slope; surface stones in some areas. Severe where slopes exceed 25 percent.
Pickwick: PcB, PcC	Slight	Slight where slopes are less than 2 percent. Moderate where slopes are 2 to 6 percent. Severe where slopes exceed 6 percent.	Slight	Slight.
Rock outcrop. Mapped only in association with Mountainburg soils.	Severe: bedrock at or near the surface.	Severe: bedrock at or near the surface.	Severe: bedrock at or near the surface.	Severe: bedrock at or near the surface.
Roellen: Ro	Severe: poorly drained; clayey surface; poor trafficability.	Severe: poorly drained; clayey surface; poor trafficability.	Severe: poorly drained; clayey surface; poor trafficability.	Severe: poorly drained; clayey surface; poor trafficability.
Spadra: SpB	Moderate: subject to occasional flooding.	Moderate: subject to occasional flooding; some slopes exceed 2 percent.	Moderate: subject to occasional flooding.	Slight.

TABLE 9.—*Degree and kind of limitation for recreational development*—Continued

Soil series and map symbols	Camp areas	Playgrounds	Picnic areas	Paths and trails
Taft: Ta	Severe: somewhat poorly drained; perched seasonal high	Severe: somewhat poorly drained; perched seasonal high	Severe: perched seasonal high water table.	Severe: perched seasonal high water table.

many places they are stony or gravelly because coarse fragments of sandstone have rolled down from the caprock on the bluffs.

Soils along the Arkansas River formed in poorly graded, well sorted alluvium deposited by flood waters. The Bruno soils formed in sandy sediment deposited along or near the river as natural levees (*15*). The McKamie, Moreland, Muskogee, and Roellen soils formed in predominantly clayey sediment deposited by

Time

The length of time required for soil formation depends largely on other factors of soil formation. Less time generally is required if the climate is warm and humid and if the vegetation is luxuriant. If other factors are equal, less time is also required if the parent material is loamy than if it is clayey.

In terms of geological time, most of the soils of

Beneath the B horizon is the C horizon. It has been little affected by the soil-forming processes, but the C horizon can be materially modified by weathering. In some young soils, the C horizon immediately underlies the A horizon and has been slightly modified by living organisms as well as by weathering.

Several processes have been active in the formation of soil horizons in Johnson County. Among these processes are accumulation of organic matter, leaching of bases, oxidation or reduction and transfer of iron, and

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge

TABLE 10.—*Soil series classified in higher categories*

Series	Family	Subgroup	Order
Bruno	Sandy, mixed, thermic	Typic Udifluvents	Entisols.
Cane	Fine-loamy, siliceous, thermic	Typic Fragiudults	Ultisols.
Caspiana	Fine-silty, mixed, thermic	Typic Arguidolls	Mollisols.
Ceda	Loamy-skeletal, siliceous, nonacid, thermic	Typic Udifluvents	Entisols.
Enders	Clayey, mixed, thermic	Typic Hapludults	Ultisols.
Guthrie	Fine-silty, siliceous, thermic	Typic Fragiaquults	Ultisols.
Leadvale	Fine-silty, siliceous, thermic	Typic Fragiudults	Ultisols.
Leesburg	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Linker	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
McKamie	Fine, mixed, thermic	Vertic Hapludalfs	Alfisols.
Moreland	Fine, mixed, thermic	Vertic Hapludolls	Mollisols.
Morganfield	Coarse-silty, mixed, nonacid, thermic	Typic Udifluvents	Entisols.
Mountainburg	Loamy-skeletal, siliceous, thermic	Lithic Hapludults	Ultisols.
Muskogee	Fine-silty, mixed, thermic	Aquic Paleudalfs	Alfisols.
Nella	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Pickwick	Fine-silty, mixed, thermic	Typic Hapludults	Ultisols.
Roellen	Fine, montmorillonitic, thermic	Vertic Haplaquolls	Mollisols.
Spadra	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
Taft	Fine-silty, siliceous, thermic	Glossaquic Fragiudults	Ultisols.

in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark red and dark brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is *Paliudults* (*Pali,* meaning old, *ud* for humid, and *ult* from Ultisols).

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in these instances where soil

proved helpful in rating soils for nonfarm uses, that is, for residential, industrial, recreational, or transportational use.

Several factors are involved in selecting soils for laboratory analyses. Soils that are extensive and most important in the survey area are considered first. A review of available laboratory data is made to determine the need for additional information on these particular soils. Generally, priority is given to soils for which little or no laboratory data are available.

In Johnson County, soils representing 12 soil series were selected for laboratory analyses. Profiles of these

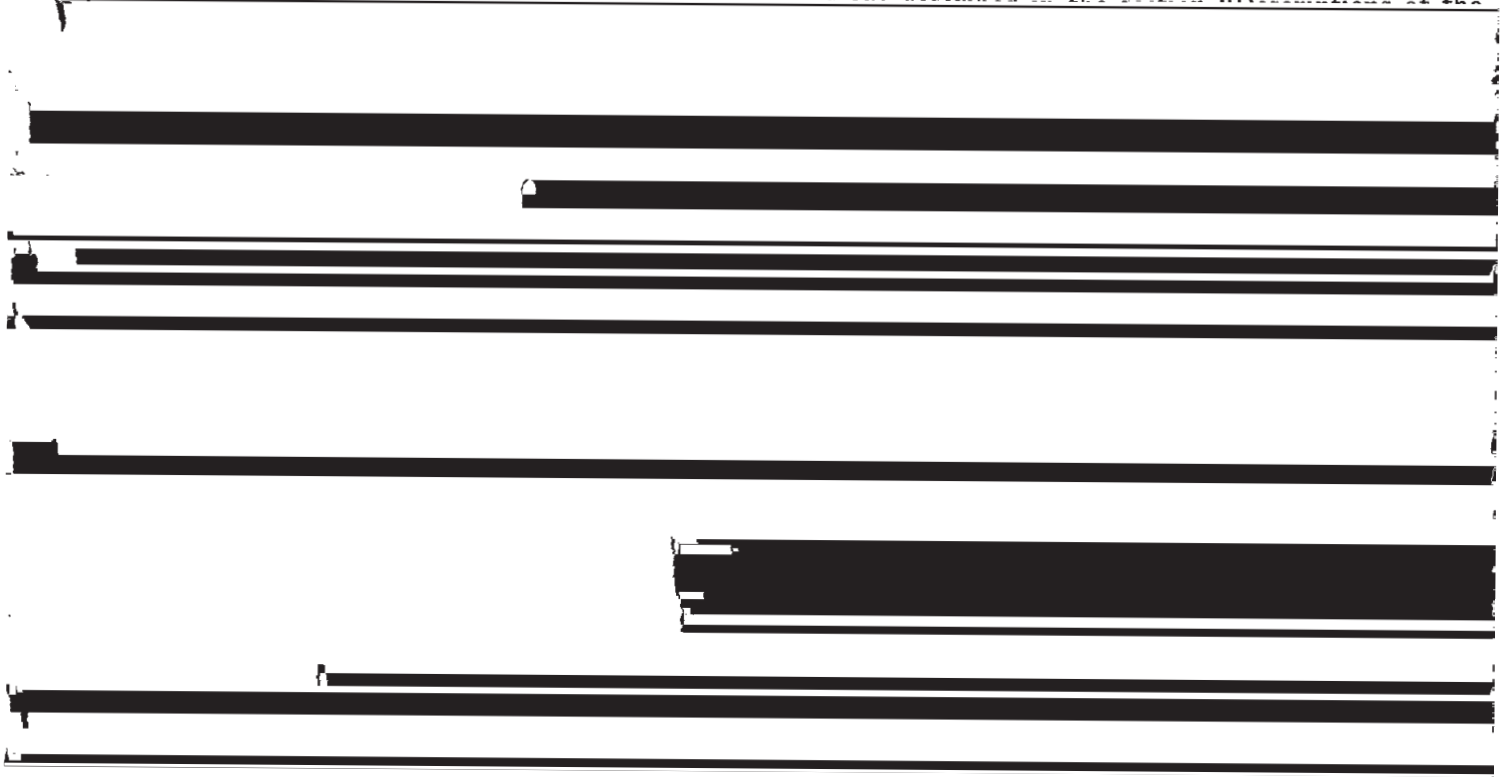


TABLE 11.—*Physical and chemical*

[Analysis made by the University of Arkansas, Fayetteville, Arkansas; dashes in place of

Soil, sample number, and depth in inches	Horizon	Particle-size distribution (smaller than 2.0 mm)					
		Very coarse through medium sand (2.0–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Total sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (0.002 mm)
		Pct	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*
Caspiana silt loam:							
S68–Ark–36–2							
0–10	Ap	----------	1	18	19	64	17
10–24	B21t	----------	----------	11	11	63	26
24–30	B22t	----------	----------	18	18	62	20
30–40	B23t	----------	----------	19	19	59	22
40–52	C	----------	----------	32	32	59	9
52–72	C2	----------	1	28	29	62	9

analyses of selected soils

[redacted]

Milliequivalents per 100 grams of soil					Base saturation	Reaction (1:1 soil-water ratio)	Organic matter
Exchangeable bases				Extractable acidity			
Calcium	Magnesium	Sodium	Potassium				
					Pct	*pH*	*Pct*
6.3	2.0	0.2	0.6	2.3	80	6.3	1.4
9.4	2.6	0.3	0.4	2.8	82	6.4	1.4
7.5	2.7	0.2	0.3	2.9	79	6.3	1.0
7.3	2.8	0.2	0.3	2.9	79	6.4	0.6
3.9	1.4	0.2	0.2	0.9	86	6.6	0.3
4.4	1.7	0.2	0.3	1.4	82	6.7	0.2
0.8	0.4	0.1	0.2	15.8	9	5.1	3.5
0.3	0.3	0.1	0.1	12.6	6	4.9	1.3
0.3	0.4	0.1	0.2	18.6	5	5.0	0.6
0.2	0.5	0.2	0.2	24.8	4	5.0	0.5
0.2	0.7	0.2	0.4	34.0	4	4.9	0.7

TABLE 11.—*Physical and chemical*

Soil, sample number, and depth in inches	Horizon	Particle-size distribution (smaller than 2.0 mm)					
		Very coarse through medium sand (2.0–0.25 mm)	Fine sand (0.25–0.10 mm)	Very fine sand (0.10–0.05 mm)	Total sand (2.0–0.05 mm)	Silt (0.05–0.002 mm)	Clay (0.002 mm)
		Pct	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*
Morganfield silt loam:							
S68–Ark–36–16							
0–7	Ap	----------	3	27	30	60	10
7–14	A12	----------	1	19	20	71	9
14–30	C1	----------	14	37	51	43	6
30–41	C2	----------	2	32	34	60	6
41–58	Ab	----------	1	13	14	71	15
58–72	IIC	----------	2	22	24	67	9
Nella gravelly fine sandy loam:							
S70–Ark–36–3							
0–3	A1	2	18	10	30	59	11
3–7	A2	3	19	11	33	55	12
7–16	B1	2	18	10	30	52	18
16–29	B21t	2	17	9	28	49	23
29–36	B22t	1	19	10	30	43	27
36–44	B23t	1	22	9	32	34	34
44–54	B24t	1	23	10	34	29	37
54–72	B25t	1	28	10	39	27	34
Pickwick silt loam:							
S68–Ark–36–6							
0–6	Ap	4	18	11	33	57	10
6–12	B1	5	11	9	25	55	20
12–22	B21t[2]	2	11	7	20	53	27
22–35	B21t[2]	4	9	9	22	51	27
35–52	B22t	2	10	7	19	43	38
52–72	B23t	3	8	8	19	42	39
Spadra fine sandy loam:							
S68–Ark–36–7							
0–8	Ap	7	13	19	39	51	10
8–21	B21t	3	15	13	31	44	25
21–39	B22t	10	16	16	42	37	21
39–55	B3	10	36	14	60	26	14
55–72	C	27	28	16	71	21	8
Taft silt loam:							
S70–Ark–36–8							
0–4	Ap	2	11	9	22	70	8
4–8	A2	1	9	9	19	62	19
8–19	B2	1	8	8	17	58	25
19–20	A′2	----------	----------	----------	----------	----------	----------
20–40	B′x	1	7	7	15	51	34
40–56	B′2t[2]	3	8	7	18	42	40
56–72	B′2t[2]	2	7	6	15	45	40

[1] Contains calcium carbonate.

General Nature of the County

Johnson County is in western Arkansas. It is bounded on the south by the Arkansas River. To the north of the river flood plain, the terrain consists of broken hills separated by creeks. This terrain gives way to more distinctly mountainous terrain in the northern part of the county. The northern part of the county lies within the Ozark National Forest.

Farming, physiography and drainage, and climate in Johnson County are discussed in the following paragraphs.

Farming

Farming in Johnson County began on soils that had good natural drainage. These soils were in higher positions near the flood plain of the Arkansas River and on the hills and in the valleys in the southern part of the county. Cotton was the main cash crop. Most areas of the better drained soils were cleared for farming, and the areas of steep, stony, or wetter soils were left in woodland.

Farming has since become more diversified and generally less intensive. In the areas of ridges and val-

analyses of selected soils—Continued

Milliequivalents per 100 grams of soil					Base saturation	Reaction (1:1 soil-water ratio)	Organic matter
Exchangeable bases				Extractable acidity			
Calcium	Magnesium	Sodium	Potassium				
					Pct	*pH*	*Pct*
8.3	0.9	0.2	0.4	0.9	92	7.5	1.2
9.6	0.7	0.2	0.2	0.7	94	7.9	0.6
5.9	0.5	0.2	0.1	0.5	93	7.9	0.3
5.2	0.6	0.2	0.1	0.5	92	7.8	0.5
9.6	1.7	0.8	0.2	0.8	94	8.1	1.1
6.5	1.5	0.7	0.2	----------	100	8.2	0.4
5.5	1.0	0.2	0.4	11.5	38	5.7	3.6
3.2	0.7	0.2	0.2	8.8	33	5.7	2.5
3.1	0.7	0.1	0.2	6.9	37	5.9	1.5
3.5	0.7	0.2	0.3	6.5	42	6.0	0.7
2.3	1.2	0.2	0.5	9.1	32	5.6	0.5
0.6	0.6	0.1	0.5	14.4	11	4.9	0.4
0.6	0.5	0.1	0.6	16.3	10	5.0	0.3
0.6	0.5	0.1	0.6	16.3	10	5.1	0.3
3.1	0.8	0.2	0.1	3.5	55	5.6	1.9
3.8	1.3	0.2	0.1	3.1	64	6.1	0.4
2.8	1.4	0.2	0.1	5.5	45	5.2	0.2
0.9	1.5	0.2	0.1	7.1	28	4.9	0.1
0.6	1.4	0.2	0.2	9.6	20	4.8	0.1
0.4	1.1	0.2	0.2	10.5	15	4.7	----------
2.2	0.5	0.1	0.1	3.9	43	5.4	1.2
3.1	1.1	0.2	0.1	5.2	47	5.5	0.6
1.3	0.8	0.2	0.1	6.7	26	5.2	0.4
0.6	0.4	0.2	0.1	5.5	19	5.2	0.3
0.5	0.4	0.1	0.1	4.8	19	5.2	0.2
3.6	0.8	0.2	0.2	7.4	39	5.3	3.3
0.9	0.6	0.2	0.1	8.3	18	4.6	1.2
1.0	0.7	0.3	0.2	9.4	19	4.8	0.5
0.4	0.7	0.7	0.1	14.7	11	5.2	0.5
1.3	2.5	2.4	0.2	14.2	31	5.2	0.4
1.0	1.7	2.3	0.2	15.3	25	5.3	0.5

[2] Thick horizons, subdivided for sampling purposes.

leys, dairying, the raising of beef cattle, hogs and pigs, and poultry, including turkeys, broiler chickens, and laying hens, now provide most of the farm income. Some of the farms have a small acreage of orchards and vineyards.

On the bottom lands along the Arkansas River, flood control, use of improved crop varieties, and other improved management techniques have led to the expansion of cropland into nearly all of the flood plain. Most of the woodland on the bottom lands along the river has been cleared, and the natural drainage has been improved for more reliable crop production on wet soils.

On these bottom land farms, soybeans is the main crop, but corn, cotton, and winter small grains are other field crops grown. Some farms grow truck crops, such as spinach, okra, green beans, and melons.

Table 12 shows the acreage of principal crops and pasture grown, and Table 13 gives the kinds and number of livestock in 1964 and 1969.

At the time of the 1969 Census of Agriculture, about 29 percent of the land area in the county was in farms. The rest was mainly in cities and built-up

TABLE 12.—*Acreage of principal crops and pasture in Johnson County in 1964 and 1969*[1]

Crops	1964	1969
	Acres	*Acres*
Cropland pastured	7,808	25,516
Woodland pastured	9,098	11,899
Hay crops	11,875	12,037
Soybeans (for beans)	4,416	6,233
Cotton	807	791
Field corn (for all purposes)	838	273
Wheat	1,645	596
Truck crops (including potatoes)	217	972
Orchards and vineyards	1,572	985

[1] A large acreage of pasture and range is not differentiated in the Census but is included in the census under "All other land." In addition, the 1964 Census and observations during the fieldwork for this survey indicate that most of the privately owned woodland is grazed

TABLE 13.—*Number of livestock in Johnson County in 1964 and 1969*

Livestock	1964	1969
All cattle and calves on farms and sold	27,533	28,344
Milk cows (Inventory)	1,206	605
Hogs and pigs on farms and sold	8,756	9,130
Chickens more than 3 months old on farms and sold	218,960	316,865
Broilers sold	4,316,750	4,565,899

topped hills, long narrow ridges, and broad valleys. The hilltops and ridges have hard sandstone caps. The hillsides and valleys are mostly underlain by shale. Slope ranges from 1 to 30 percent, and elevation ranges from about 420 to about 1,000 feet. This area

TABLE 14.—*Temperature and precipitation*

[All data from Clarksville during the period 1954–72]

Month	Average daily temperature	Average monthly precipitation
	°F	*Inches*
January	39.2	2.5
February	43.7	3.2
March	50.6	3.9
April	62.7	4.5
May	69.9	5.5
June	77.0	3.9
July	81.4	4.1
August	80.2	3.2
September	74.1	3.9
October	62.9	3.4
November	50.7	3.5
December	42.3	4.0
Year	61.2	45.6

Evaporation rates in summer are as much as a third of an inch per day. As a result, periods that have abundant sunshine and high temperature may experience the loss of a considerable amount of soil moisture.

The bottom lands are fertile and produce large amounts of soybeans, cotton, hay, and small grains. The uplands, although not so fertile as the lowlands, provide grazing throughout most of the year because of the mild winter temperature and adequate rainfall.

The climate is suited to growing vegetables and fruit. Among the principal crops are peaches and grapes. The mild winters and abundant rainfall are conducive to plant growth.

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Glossary

ABC soil. A soil that has a complete profile, including an A, B, and C horizon.

AC soil. A soil that has an A horizon and a C horizon but no B horizon. Commonly such soils are immature, as those developing from alluvium or those on steep, rocky slopes.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity. The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

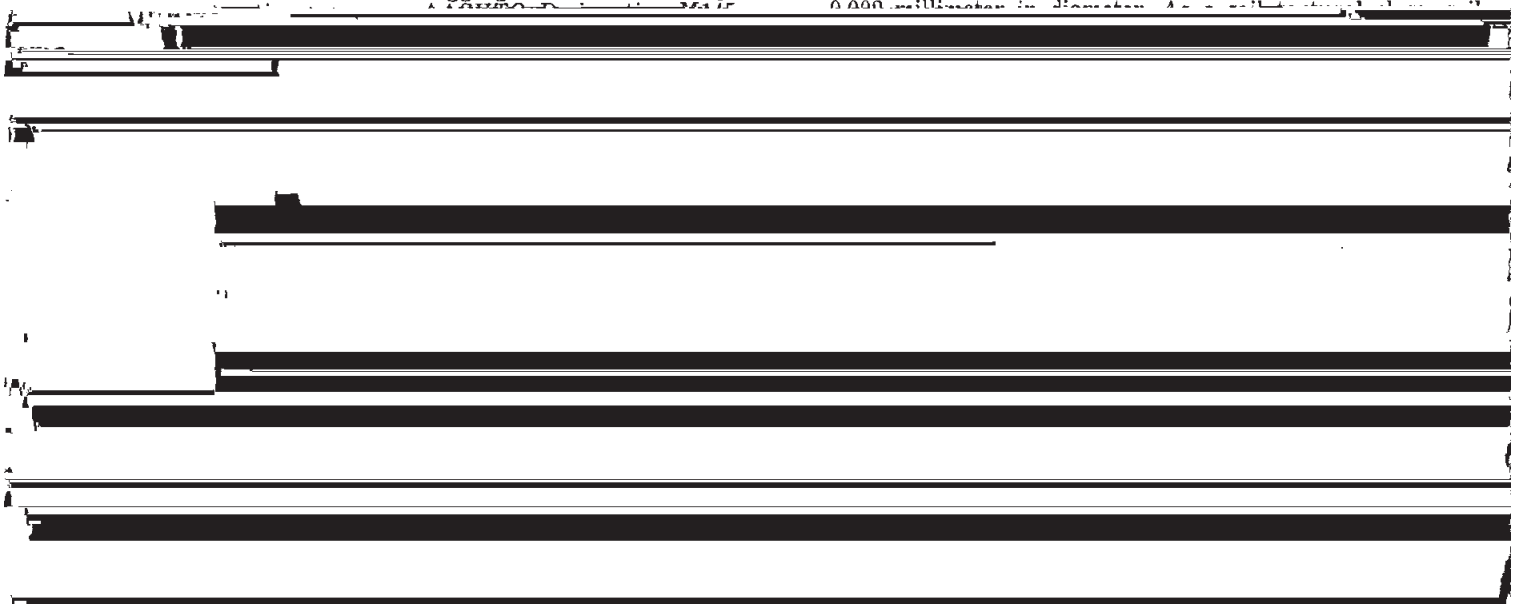
Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Chiseling. Tillage of soil with an implement having one or more soil penetrating points that loosen the subsoil and brings *clods* to the surface. A form of emerging tillage to control soil blowing.

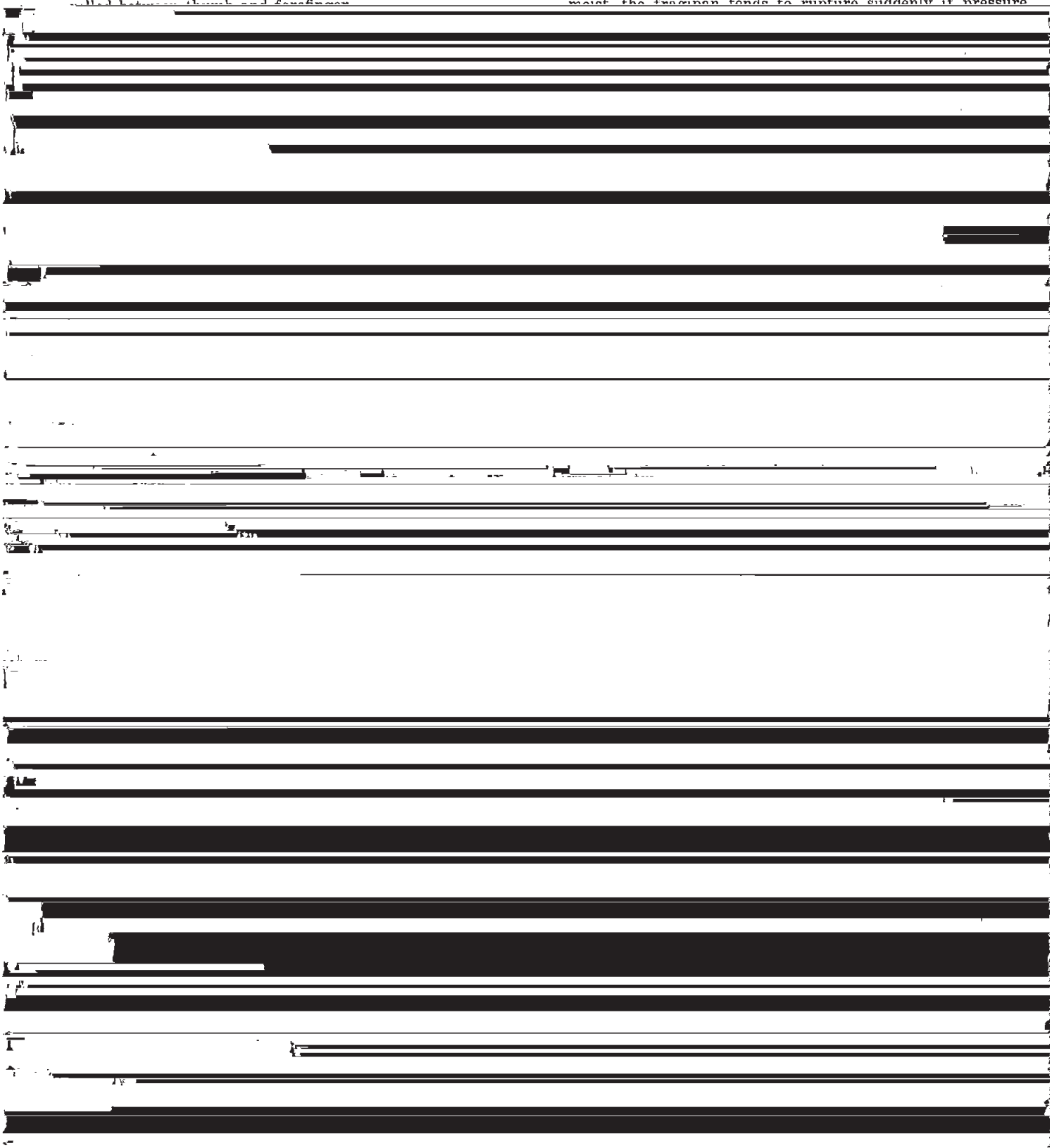
Clay. As a soil separate, the mineral soil particles less than



Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure



[redacted]

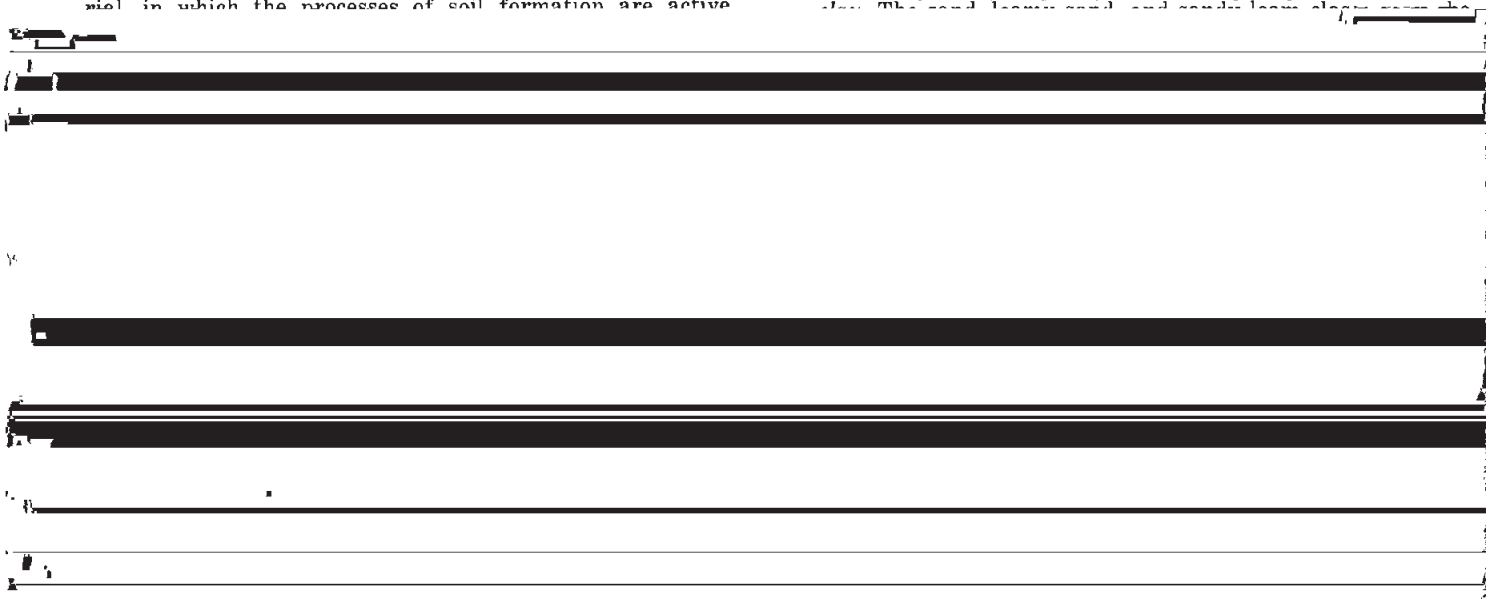
Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active.

Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

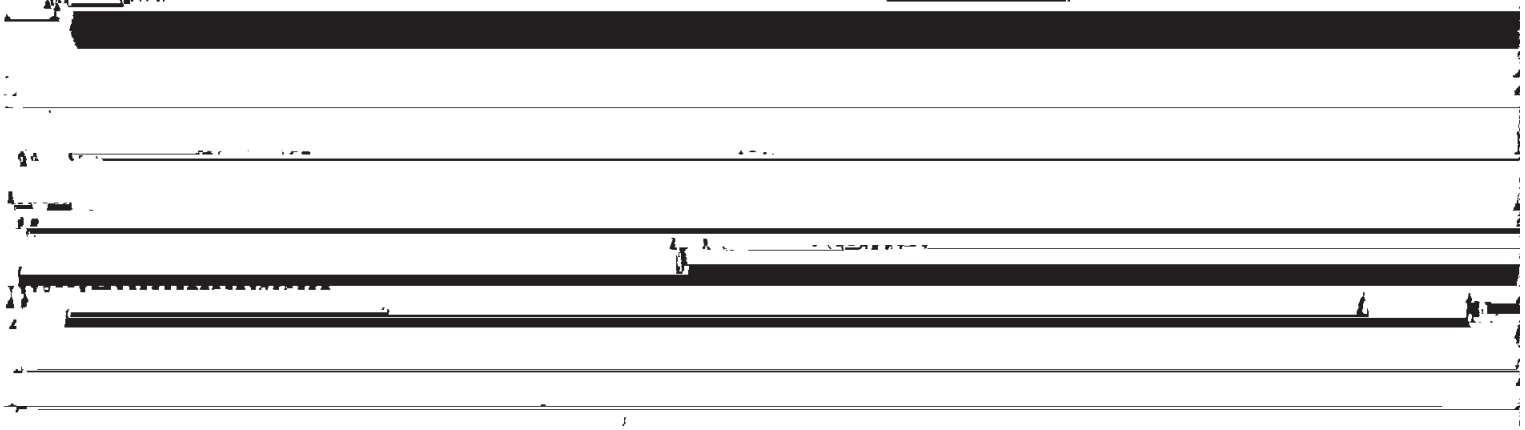
Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be



GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. The suitability of the soils for use as cropland and pasture is discussed in the soil descriptions. For information about the capability grouping, refer to page 29. For information about the suitability of the soils as woodland or for wildlife habitat, read the introduction to that section and refer to the table in each section.

Map symbol	Mapping unit	Page	Capability unit	Pasture and hayland group		Woodland suitability group	Range site
			Symbol	Symbol	Page	Symbol	Name
Br	Bruno loamy fine sand	6	IIIs-1	3B	33	2s5	----------
CaB	Cane fine sandy loam, 1 to 3 percent slopes	7	IIe-1	8A	33	3o7	----------
CaC	Cane fine sandy loam, 3 to 8 percent slopes	8	IIIe-1	8A	33	3o7	----------
Cp	Caspiana silt loam	8	I-1	2A	33	2o4	----------
Cy	Ceda cobbly fine sandy loam	9	VIIs-1	2B	33	3x9	----------
EnD	Enders gravelly fine sandy loam, 5 to 15 percent slopes	10	VIe-1	8C	33	4o1	Clay Break, Shale
EMD	Enders-Mountainburg association, rolling	10	------	---	--	---	----------
	Enders soils	--	VIIs-2	8D	33	4x2	Clay Break, Shale
	Mountainburg soils	--	VIIs-3	14B	34	5x3	Sandstone Ridge
EME	Enders-Mountainburg association, steep	10	------	---	--	---	----------
	Enders soils	--	VIIs-2	8D	33	4x2	Clay Break, Shale
	Mountainburg soils	--	VIIs-3	14B	34	5x3	Sandstone Ridge
Ge	Guthrie silt loam	11	IVw-1	8F	34	2w9	----------
LeB	Leadvale silt loam, 1 to 3 percent slopes	12	IIe-1	8A	33	3o7	----------
LeC	Leadvale silt loam, 3 to 8 percent slopes	12	IIIe-1	8A	33	3o7	----------
LBD	Leesburg association, rolling	13	VIe-2	8B	33	3o7	----------
LBE	Leesburg association, steep	14	VIIe-1	8B	33	3r8	----------
LEE	Leesburg-Enders association, steep	14	------	---	--	---	----------
	Leesburg soils	--	VIIe-1	8B	33	3r8	----------
	Enders soils	--	VIIs-2	8D	33	4x2	Clay Break, Shale
LEF	Leesburg-Enders association, very steep	14	------	---	--	---	----------
	Leesburg soils	--	VIIe-1	8B	33	3r9	----------
	Enders soils	--	VIIs-2	8D	33	5r3	Clay Break, Shale
LnB	Linker fine sandy loam, 1 to 3 percent slopes	15	IIe-1	8A	33	4o1	Loamy Upland
LnC	Linker fine sandy loam, 3 to 8 percent slopes	15	IIIe-1	8A	33	4o1	Loamy Upland
LnD	Linker fine sandy loam, 8 to 12 percent slopes	15	IVe-1	8A	33	4o1	Loamy Upland
LKD	Linker association, rolling	15	IVe-1	8A	33	4o1	Loamy Upland
LMD	Linker-Mountainburg association, rolling	16	------	---	--	---	----------
	Linker soils	--	VIe-2	8B	33	4o1	Loamy Upland
	Mountainburg soils	--	VIIs-3	14B	34	5x3	Sandstone Ridge
McC	McKamie silt loam, 3 to 8 percent slopes	17	IVe-2	8C	33	3c2	----------
Md	Moreland clay	18	IIw-1	1A	31	2w6	----------



Map symbol	Mapping unit	Page	Capability unit	Pasture and hayland group		Woodland suitability group	Range site
			Symbol	Symbol	Page	Symbol	Name
MRF	Mountainburg-Rock outcrop association, very steep	21	------	---	--	---	----------
	Mountainburg soils	--	VIIs-3	14B	34	5x3	Sandstone Ridge
	Rock outcrop	--	------	---	--	---	----------
MzB	Muskogee silt loam, 1 to 3 percent slopes	22	IIe-1	8A	33	3o7	----------
NaB	Nella gravelly fine sandy loam, 1 to 3 percent slopes	23	IIe-1	8A	33	3o7	----------
NaC	Nella gravelly fine sandy loam, 3 to 8 percent slopes	23	IIIe-1	8A	33	3o7	----------
NaD	Nella gravelly fine sandy loam, 8 to 12						

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